School of Nursing and Midwifery
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Improving Health Outcomes by Preventing Intensive Care Related Infection in Malaysia Intensive Care Unit (INVEST Study)

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: ……

Date: 13 August 2012

Abstract

Ventilator-associated pneumonia (VAP), catheter-related blood stream infection (CRBSI) and pressure ulcers (PU) are well recognized complications in intensive care units (ICUs). Many of these are preventable but can also complicate patient recovery, prolong length of stay, increase costs, morbidity and mortality. In Malaysia, the majority of studies investigating VAP and CRBSI in Malaysia have focussed on identifying risk factors, diagnostic criteria and treatment of ICU-related complications. Further, in spite of the burden of PU there are limited studies undertaken in Malaysia and few of these have been nurse-led. Importantly, to date there has been limited investigation of the efficacy and effectiveness of quality improvement initiatives and the contextual issues impacting on clinical practice improvement in Malaysia.

In spite of the increasing emphasis on quality assurance in Malaysian ICUs there has been a limited focus on nurse-specific interventions and the majority of projects have been initiated by physicians. This study has evaluated the utility of a nurse-led action research project to drive clinical practice improvement in the ICU and is significant in demonstrating the capacity of nurses to critique and control their practice. The project conducted for this thesis was called the *Improving health outcomes by preveNting intensiVe care related infEction in Malaysia intenSive care uniT* - INVEST study. The INVEST Study as reported in this thesis has been undertaken using an action research approach to improve the uptake of evidence-based strategies to prevent infection in the ICU in the Malaysian cultural context. The aims of this thesis were to identify best practices, evaluate the current nursing practice in prevention of VAP, CRBSI and PU in ICU patients in a single Malaysian ICU, and evaluate the impact of the evidence-based interventions to improve patient outcomes. The specific and research objectives of this study were to:

1. Identify best practice interventions for preventing VAP, CRBSI and PU in the ICU.
2. Document the current rates of VAP, CRBSI and PU in an ICU in Malaysia.

3. Implement an action research intervention to collaboratively develop and implement strategies for improvement
4. Assess the impact of the intervention on clinical outcomes, staff dynamics, work place culture and sustainability of practice change

An action research approach was used in this study to involve and empower nurses and drive practice change. A literature review identified that many action research studies conducted in the ICU were mainly most focused on process measures and not outcomes. In this study the data were collected in three phases following the action research cycles which comprised of a period of planning, acting, observation, reflecting and re-planning.

In Phase I of the thesis current best practice interventions for the prevention of VAP, CRBSI and PU in ICU are described. A literature search was conducted to identify evidence-based practices (EBP) that were recommended by bodies to improve the prevention of VAP, CRBSI and PU. A core set of nursing activities was identified in preventing the complications of VAP, CRBSI and PU. These were hand washing, hygiene care, positioning of patient, elevation of the head of bed and providing adequate nutrition.

Pre- intervention data collection consisted of an environmental scan, including interview with the key stakeholders, patient profiling and a nurse survey. Twenty-one cases of ICU complications were identified in 18 of the 91 patients (19.8%) admitted in December 2009. Of the patients, three developed two complications - PU and VAP (two patients) or CRBSI (one patient). The findings indicated that this ICU had a high case load due to the high ICU bed demand. Patients needing ICU care were being nursed in general wards due to the unavailability of ICU beds.

Nurses reported a good knowledge of prevention strategies with a mean score of 124.84 ±SD14.66 and reported a high level of positive regard for their professional practice environment based on the results of Revised Professional Practice Environment (RPPE). Three components had mean scores of ≥ 3 and five <3 within the eight components. Three components of RPPE subscales with highest mean

scores were *Internal Work Motivation* (M 3.24; SD 0.3), *Relationship With Physician* (M 3.22; SD 0.53) and *Cultural Sensitivity* (M 3.04; SD 0.24). The two lowest mean scores were for *Handling Disagreement* and *Teamwork* with 2.77 (SD 0.16) and 2.45 (SD 0.47), respectively. Nurses also showed positive attitudes toward the sustainability of the change process. The Sustainability Indices ranged from 13.4 to 100 with a mean of 75.21 (SD 21.71).

In Phase 2 the intervention was conducted over six months from February to July 2010. The Center of Disease Control and Prevention (CDC) criteria for diagnosis of VAP and CRBSI, and the Waterlow Pressure Ulcer Risk Assessment Scale were promoted in the unit. Nurses were exposed and encouraged to implement evidence-based nursing interventions as identified in care criteria. All nurses were invited to the unit nursing education to increase their knowledge and awareness about evidence-based practice in prevention of the ICU complications. Nurses were encouraged to gain control of their practice. Evidence-based practice articles were also provided to increase their knowledge level and posters were distributed and placed in the unit to increase nurses awareness of the quality improvement initiatives.

Focus group discussions were conducted in Phase 2 and found that nurses in the unit were unaware of the importance of standardized assessment in their daily practice. They had a lack of understanding regarding the importance of standardised risk assessments. Despite the reluctance of many nurses to embrace the EBP, due to a perception of their workload, the focus groups also revealed nurses were optimistic that change will get easier and could be eventually achieved. Participants were positive about the change that could take place in the future. The hierarchical relationships with medical doctors were also identified as a factor limiting nurses from adopting the guidelines.

Phase 3 of the project, the post-intervention phase was conducted from March to May 2011. The data collection process was repeated as Phase 1 and Phase 2. There were 11 cases of ICU complications identified during the post-intervention phase in 10 (8.7%) of the 115 patients admitted during March 2011. One patient developed both VAP and PU, while four developed VAP and another five PU. In the post-

intervention group, no cases of CRBSI were detected. The total mean score of nurses' knowledge was 121.45±SD16.85. An independent-samples t-test was conducted to compare nurses' knowledge pre and post intervention, and found no significant differences, t (150) =1.32, *P* 0.189. The Sustainability Indices ranged from 41.3 to 100 percent with a mean of 76.81±SD21.45. Approximately 84% of the nurses in pre-intervention and 70% in post-intervention scored >55%. The nurses reported a positive regard for their practice environment in the pre- and post-intervention groups. The mean scores for each component were comparable for both the pre- and post-intervention groups except for *Internal Work Motivation, Control Over Practice* and *Staff Relationship With Physician*. The highest mean scores within the eight components for the post-intervention group were for *Internal Work Motivation* (M 3.13; SD 0.27), *Relationship With Physician* (M 3.04; SD 0.33) and *Cultural Sensitivity* (M 3.01; SD 0.23). The three lowest were for *Handling Disagreement and Conflict* (2.80; SD 0.20), *Control Over Practice* (2.71; SD 0.34) and *Teamwork* (2.48; SD 0.31).

There was a reduction in overall complications from 19.8% to 8.7%. Few nurses in the focus group were optimistic that at least some changes had taken place, and positively improving their knowledge on assessment of patients and some of their common practices in the ICU. The challenge, which they were presently facing was the implementation of hospital information system because most of them were not knowledgeable in information technology.

The main outcome of this study was that there was a reduction in number of patients with PU from 16 to 6 in pre and post intervention groups. This reduction of PU was statistically significant (χ^2=8.14, df=1, p=0.04).

In conclusion whether there was a real improvement in patient care provided due to the interventions given was not able to be determined due to methodological considerations and inability to control for confounders. These data underscore the importance of considering cultural factors, both organisational and societal in quality improvement initiatives and empowering nurses for practice change. A risk management system which acknowledges competing demands in dynamic, real

world environments is important to consider in future quality improvement studies. The series of studies presented in this thesis have contributed to understanding of factors influencing implementation and sustainability of quality improvement initiatives in a Malaysia ICU. Information acquired from the thesis will be useful information for further improvement targeting education, services, research, policy and future quality improvement project plans in Malaysia.

Dedication

I dedicate this thesis to my late father Mr Soh Kiat Seng and many who have supported this thesis along the journey.

My Family

Supportive sisters and brother in-laws (OSB, OSL, SKG, WTA, TCH), nephews (Yujing, Yuhao, Yuhan, Harry), nieces (Hannah, Hermione), and mother (Madam Teo Chan Choo)

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Table of Contents

List of Appendices

List of Tables

List of Figures

Figure Credits and Permissions

Figure listed below have been marked “Used by permission” in text.

Figure	Title	Copyright holder	Permission Obtained
2.1	Guidelines for Staging of Pressure Ulcers	National Pressure Ulcers Advisory Panel (2007)	3.10.2011
3.1	Action research diagram	The Higher Education Academy	30.09.2011

Publications Rising from this Thesis

Based on Chapter	Type/ Status/ Permission*	Year	Journal	Authors	Title
3	PRJ/ Published/ Permission Granted to use paper in thesis	2011	International Journal of Nursing Studies	Soh, K. L. Davidson, P. M. Leslie, G. Rahman, A.B.A.	Action research studies in the intensive care setting: A systematic review
5	PRJ/ Published/ Permission Granted to use paper in thesis	2011	International Journal of Multiple Research Approaches	Soh, K.L. Davidson, P.M. Leslie, G. DiGiacomo, M. Rolley, J.X. Soh, K.G. Rahman, A.A.	Factors to drive clinical practice improvement in a Malaysian intensive care unit: Assessment of organizational readiness using a mixed method approach
Across chapters Two-Nine	PRJ/ Published/ Work not directly used in thesis	2011	Journal of Clinical Nursing	Soh, K.L. Soh, K.G. Japar, S. Abdul Raman, R. Davidson, P.M.	A cross-sectional study on nurses' oral care practice for mechanically ventilated patients in Malaysia
6	PRJ/ Accepted/ Permission applied for	2012	Journal of Clinical Nursing	Soh, K.L. Davidson, P.M. Leslie, G. DiGiacomo, M. Soh, K.G.	Nurses' perceptions of standardised assessment and prevention of complications in a Malaysian intensive care unit: A qualitative study

Across chapters Five-Nine	PRJ/Under Review/work not directly used in thesis	2011	Journal of Hospital Administration	Soh, K.L. Davidson, P.M. Soh, K.G	The role of culture in quality improvement in the intensive care unit
7	PRJ/Under review	2012	Australian Critical Care	Soh, K.L. Davidson, P.M. Leslie, G. DiGiacomo, M. Rolley, J.X. Soh, K.G. Mohd Noor,M.R.	Quality improvement in the intensive care unit: evaluation of action research project
8	PRJ/Under review	2012	Nursing and Health Sciences	Soh, K.L. Davidson, P.M. Leslie, G. DiGiacomo, M. Soh, K.G.	Nurses' perceptions of the sustainability of standardised assessment for preventing complications in a Malaysian intensive care unit: A qualitative study

PRJ = Peer Review Journal
*See Appendices 6.1 and 6.2 for permission documents

Abbreviations

Abbreviation	Full Term
CCI	Charlson Comorbidity Index
CDC	The Centers for Disease Control and Prevention
CNE	Continuous Nursing Education
CINAHL	Cumulative Index of Nursing & Allied Health Literature
CRBSI	Catheter Related Blood Stream Infection
CVC	Central Venous Catheter
CVP	Central Venous Pressure
EBP	Evidence-based Practice
GCS	Glasgow Coma Score
HIS	Hospital Information System
IT	Information Technology
ICU	Intensive Care Unit
NAICU	The National Audit on Adult Intensive Care Unit
NPUAP	National Pressure Ulcer Advisory Panel
MeSH	Medical Subject Headings
MOH	Ministry of Health
RPPE	Revised Professional Practice Environment Scale
PU	Pressure Ulcer
RM	Ringgit Malaysia
SAPS II	Simplified Acute Physiology Score
SOFA	Sequential Organ Failure Assessment
USD	United States Dollar
VAP	Ventilator-Associated Pneumonia

Glossary

Terms		Definition
Action research	:	Action research is a method to integrate the perspectives of theory, research and practice and provides a framework for closing the evidence / practice gap.
Bundles	:	A bundle is a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices - generally three to five - that, when performed collectively and reliably, have been proven to improve patient outcomes.
Catheter-Associated BSI	:	Vascular access device that terminates at or is close to the heart or one of the great vessels. BSI is considered to be associated with a central line if the line was in use during the 48-hour period before development of the BSI. If the time interval between onset of the infection and device use is >48 hours, there should be compelling evidence that the infection is related to the central line.
Charlson co-morbidity index	:	The Charlson co-morbidity index predicts the one-year mortality for a patient who may have a range of co-morbid conditions such as heart disease, AIDS, or cancer (a total of 22 conditions).

Catheter related blood stream infection	:	Bacteremia/fungaemia in a patient an intravascular catheter with at least one positive blood culture obtained from a peripheral vein, clinical manifestations of infections (i.e., fever, chills, and/or hypotension), and no apparent source for the BSI except the catheter. One of the following should be present: a positive semiquantitative (>15 CFU/catheter segment) or quantitative (>103 CFU/catheter segment catheter) culture whereby the same organism (species and antibiogram) is isolated from the catheter segment and peripheral blood; simultaneous quantitative blood cultures with a >5:1 ratio CVC versus peripheral; differential period of CVC culture versus peripheral blood culture positivity of >2 hours.
Mixed-method	:	A research method employing quantitative and qualitative approaches to investigate complex phenomenon with the intention of developing a synthesis of findings.
Pressure ulcer	:	Pressure ulcer is defined as a localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction.
Severity of disease score	:	Simplified Acute Physiology Score (SAP II), a severity of disease score, and Sequential Organ Failure Assessment (SOFA), organ dysfunction score, scoring systems have been developed for use in critically ill patients.
Ventilator-associated pneumonia	:	Ventilator-associated pneumonia refers to pneumonia developing in mechanically-ventilated patients more than 48 hours (2 days) after intubation.

CHAPTER ONE

INTRODUCTION

CHAPTER 1
INTRODUCTION

1.1 Background

Internationally there is an increasing need to reconfigure health care systems to improve the quality, safety, efficiency and effectiveness of patient care.[1, 2] Preventable medical errors and nosocomial infections have been shown to contribute adversely to health outcomes, particularly in the intensive care unit (ICU). Failures in communication, poor adherence to guidelines and a failure to translate research evidence into practice have been identified as barriers to optimal patient care.[3] Major foci for quality improvement initiatives in the ICU include sepsis management[4] and prevention of complications, such as catheter-related blood stream infection (CRBSI),[5, 6] ventilator-associated pneumonia (VAP)[7, 8] and pressure ulcers (PUs).[9, 10]

Infections contracted in the ICU complicate the patient's recovery as well as increasing the length of stay and costs of hospitalization as well as increasing morbidity and mortality.[11-19] Managing ICU infections can increase the complexity of clinical management.[20] Therefore improving measures for infection prevention are important for decreasing hospital-acquired infections.[20] As part of this thesis a quality improvement project was undertaken targeting preventing three common complications in the ICU, specifically VAP, CRBSI and PUs. An action research methodology was adopted because of the inclusive and enabling framework and the potential of sustainability of clinical practice improvement.

The project undertaken for this thesis was called the *Improving health outcomes by preveNting intensiVe care related infEction in Malaysia intenSive care uniT* - INVEST study. A novel aspect of this study is that instead of focussing on a single condition, a mapping of common nursing interventions to address these three common adverse events were identified to allow a multi-pronged approach to addressing them and to improve patient outcomes (Figure 1.1). This study was

undertaken in a major ICU in regional Malaysia. An important and novel aspect of this study within the Malaysian context is that it was a nurse-led project. In spite of the increasing emphasis on quality assurance in Malaysian ICUs there has been limited focus on nurse-specific interventions and to date these have been initiated by physicians.

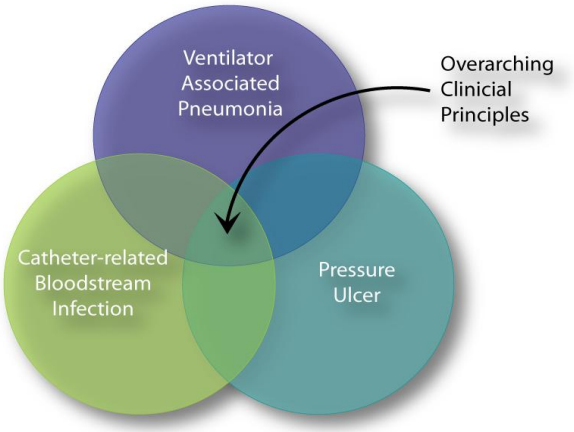

Figure 1.1 Convergence of nursing care principles to prevent ventilator-associated pneumonia, catheter-related blood stream infections and pressure ulcers

1.2 Exploring the overarching clinical principles of interdisciplinary care

A core set of nursing activities were identified as important in preventing VAP, CRBSI and PU in the ICU. Implementing these activities, namely a strict hand washing protocol, hygiene care, positioning of the patient, elevation of the head of the bed and providing adequate nutrition, are advocated in preventing these complications in the ICU (Table 1.1). Some of these activities are included in the evidence-based practice (EBP) guidelines recommended for implementation in ICUs.[6, 9, 21-24]

Table 1.1 Strategies for VAP, CRBSI and PU prophylaxis

No	Nursing Care	VAP	CRBSI	PU	Reference
1	**Assessment**				
	Gastric residual	✓			
	Skin		✓	✓	23, 25, 26
	Oropharyngeal	✓			
2	**Hand washing**	✓	✓	✓	27, 28
3	**Nutrition**	✓	✓	✓	26, 29
	Regular weight monitoring	✓	✓	✓	
4	**Hygiene**				
	Oral / subglottic suctioning	✓			30-33
	Bathing		✓	✓	34, 35
	Frequent changes of moist linen		✓	✓	
	Dressing choice		✓		27, 28
5	**Barrier precautions**	✓	✓	✓	23, 27, 28
6	**Therapeutic positioning**				
	Head of bed	✓		✓	8, 33, 36-39
	Repositioning	✓		✓	26, 29
	Early mobilisation	✓		✓	40, 41
	Support surface	✓		✓	26, 29
7	**Screening**				
	Culture and sensitivity	✓	✓	✓	42, 43

Guideline implementation can result in significant improvements in the process of care.[44] However, implementing EBP is not easy and can be challenging for a range of reasons. Analysis of barriers and facilitators to the uptake of guidelines demonstrate obstacles to change in practice at the patient, professional, health care team, health care organization and practice environment levels.[45-48] Pronovost and Sexton[49] have identified the importance of understanding safety culture factors. These factors include staff characteristics, the patient care area, the department and variations in hospital culture. Single research approaches do not allow an understanding of the complex and multifaceted clinical milieu; therefore, mixed method approaches are better suited to increasing understanding of these contextual factors.[50] Mixed method approaches use of both qualitative and quantitative methods of data collection in a single study able to provide the best understanding of a research problem.[50, 51]

Hansen and Severinsson [52] have indicated that a gap exists between evidence and practice in the ICU. Action research is a method to integrate the perspectives of theory, research and practice[53-55] and therefore provides a framework for closing the evidence / practice gap. Implementing EBP strategies and improving clinical practice standards is an important concern to improve clinical care in the ICU. Whether under the nomenclature of action research or clinical practice improvement these projects seek to improve patient outcomes.

The process of action research can generate new knowledge, as well as empowering and engaging participants[56] allowing a dynamic interaction between researchers and driving organisational change. When undertaking strategies to improve clinical practice, it is important to consider these contextual factors, and action research allows such an approach.[57] Action research readily lends itself to improving work practices and promotes sustainability.[56]

Even though implementing EBP can improve patient outcomes,[58] this has been documented as a challenging process. The change process creates stress and may cause conflict in the clinical setting due to the challenging of traditional roles,

expectations and relationships.[59] Instances of personal animosity, mistrust and communication gaps have been identified.[60] Understanding staff characteristics, the patient care area, the department and variations in hospital culture is crucial for making change happen in the clinical setting.[49] As a consequence, conflicts need be identified and managed at an early stage.[59] Consideration of the organisational context, culture and relationships is vital in resolving conflict.[59]

Despite many studies evaluating adherence to clinical practice guidelines in the Western world,[21, 46, 61] in different health care systems with different organisational and cultural backgrounds, such as in Malaysia, the barriers and facilitators of the organisation to accept and implement prescribed clinical guidelines is less well understood. Organisational factors, including the cultural influences that potentially hamper or sustain EBP, need be identified.[62, 63] A discrepancy was found between self report and the observed actual practice in a study on the nurses' oral care for ventilated patients in three ICUs in Malaysia.[64] The INVEST Study as reported in this thesis has been undertaken using an action research approach to improve the uptake of evidence-based strategies to prevent infection in the ICU in the Malaysian cultural context. Failing to consider clinical outcomes was identified as a limitation of action research to date.[65] Therefore as well as considering outcomes of VAP, CRBSI, and PU the INVEST Study considered organizational readiness, and issues of sustainability of clinical practice improvement in a Malaysian ICU. In any action research project it is important to consider contextual factors. The following section provides a description of the Malaysian health care system.

1.3 Malaysian health care system

The Malaysian health care system is divided into two sectors—the public sector and the private sector. The Ministry of Health is the biggest health care provider in the country.[66] Intensive care is among the major clinical specialty services provided by the Ministry of Health hospitals.[66] All ICUs in Malaysia are mixed medical and surgical units classified as Level 3 with facilities for multiple

organ support, e.g. mechanical ventilation and renal replacement.[67] All the ICUs operate as 'closed units' directed by an intensivist or anaesthetist. The number of beds range from 16 to 35 (approximately 3-5% of acute hospital beds) depending on the services provided by the hospital.[66]

Intensivists in Malaysia complete five years basic medical degree with additional four years postgraduate qualification.[68] After that they undertake two years full time subspecialty training in intensive care locally or abroad such as in the UK, Australia and the USA.[69, 70] During the subspecialty period they have to go through supervise training and up-taking full time clinical attachments in various ICUs.[70]

This study was conducted in a general ICU of an urban Ministry of Health hospital built in 1986 catering to all medical surgical cases for the State. The hospital has 821 beds, 28 wards, 9 specialist clinics, 16 operating theatres, 13 labour rooms and one labour room operating theatre and 19 clinical specialities. It is the only government referral centre for the State. The ICU is staffed by intensivists, anaesthetists and nurses. Nurses are predominately women and working full time in the hospital setting.

1.4 Aim

The aim of the INVEST study was to identify best practices, evaluate the current nursing practice in prevention of VAP, CRBSI and PU in a single Malaysian ICU, and evaluate the effectiveness of an action research project to improve patient outcomes.

1.5 Objectives and research questions

In the following section the specific research objectives of the three phases of the INVEST Study are provided and the associated research questions.

1.5.1 Phase one research objectives

1. Identify best practice interventions for preventing VAP, CRBSI and PU in the ICU.

2. Document the current rates of VAP, CRBSI and PU in a single Malaysian ICU.

Research questions

- What are the best practice interventions for preventing VAP, CRBSI and PU in the ICU?
- What are the rates of VAP, CRBSI and PU in a single Malaysian ICU?

1.5.2 Phase two research objectives

3. Implement an action research intervention to collaboratively develop and implement strategies for improvement

Research questions

- What are the factors impacting on VAP, CRBSI and PU assessments?
- In what way do nurses perceive change processes in the ICU?
- In what way can nurses facilitate the sustainability of change processes in the ICU?

1.5.3 Phase three research objectives

4. Assess the impact of the intervention on clinical outcomes, staff dynamics, work place culture and sustainability of practice change

Research questions

- What has been the experience of change in the assessment process of VAP, CRBSI and PU over the past twelve months?
- In what way did the experience present any challenges during implementation and maintenance of the change process?
- What were the facilitators of implementing and sustaining change in the ICU?

1.6 Method overview and justification

The action research approach was used to evaluate the current practices for prevention of VAP, CRBSI and PU in the ICU. Although quality improvement processes are well instituted in many ICUs, systematic action research studies are less well documented in the literature.[65] Action research is a method integrating perspectives of theory, research and practice.[53-55] A significant characteristic between administrative quality improvement initiatives and action research is the collaborative relationship between researchers and participants and the emphasis on empowerment and control over practice.[56] As many of the prevention strategies for VAP, CRBSI and PU are common, for example, hand washing, this study takes a novel approach as it seeks to develop a broad ranging, multifaceted approach to clinical practice improvement rather than focus on single clinical conditions.

This action research was based on *The Clinical Practice Improvement Model* adapted from the Institute of Health Care Improvement in the United States of America (USA).[71] The model is a powerful tool to accelerate improvement in a health care organization. A defining characteristic of action research is the

continuous relationships between research, action, reflection and evaluation.[72] In addition to generating new knowledge, the major aspects of action research are empowerment and staff engagement.[56] Action research is context specific and focuses on education and empowerment[56, 72, 73] guided by prospective research questions and addressed collaboratively with participants.[55, 56, 73] The implementation of action research is participatory and engaging rather than prescriptive and authoritative.[56, 73] In this study, action research used a mixed methods approach including an environmental scan, chart audits, interviews, survey and focus group discussion.

The infection control practice recommendations from the Center for Disease Control and Prevention (CDC)[28, 74] and Institute of Health Care Improvement (IHI)[71, 75, 76] and the Australian Clinical Excellence Commission (CEC)[77-79] were selected as benchmarks to guide the evaluation process of prevention of VAP, CRBSI, and PU. The recommendations from these organizations were selected due to their credibility in setting standards for improving the quality and safety of care provided by health care organizations.[80]

The majority of published materials in Malaysia report on baseline surveillance and management of nosocomial infections, and antibiotic use for the treatment.[81-83] To date there are limited published materials to guide further infection prevention. This study focussed on empowering and engaging nurses to utilise EBP. A key emphasis of this action research project was empowering staff and developing capacity to ensure sustainable practice improvement and implementation of EBPs to minimise VAP, CRBSI and PU.

1.7 Significance

Nosocomial infections in the ICU are common, costly and deadly.[12] Preventing complications is a major focus of clinicians and administrators. The majority of studies on VAP and CRBSI in Malaysia have focussed on identifying the risk factors, diagnosis and treatment characteristics of ICU-related complications.[81-92] There are limited data on the contextual issues impacting on clinical practice. Similarly in spite of the burden of PU there are limited studies undertaken in Malaysia. There is limited evidence of the efficacy and effectiveness of quality improvement initiatives in Malaysia, particularly those that are nurse-led. This study has evaluated the utility of a nurse-led action research project to drive clinical practice improvement in the ICU and is significant in demonstrating the capacity of nurses to critique and control their practice.

1.8 Thesis structure

Sequential studies conducted in accordance with action research cycles were interpreted in a mixed method model. This approachs was designed to obtain an in-depth understanding of the barriers and facilitators to improving care for ICU patients. This thesis is divided into nine chapters. Each chapter includes a description of relevant methodology and discussion for each phase of the study. Therefore there may be some repetition between chapters but this has been done to increase clarity for the reader. References are listed at the end of each chapter and study instruments and ethical approvals copies are provided in the appendices. A brief summary of each of the chapters is provided below:

Chapter One - Introduction

Chapter one has provided a description of the background and rationale to the study and significance. It has provided objectives, research questions, method overview and a description of the thesis structure.

Chapter Two - Complications in ICU

This chapter examines the current research in fields relevant to this thesis. The literature review focuses on VAP, CRBSI and PU prevention. This review describes the prevalence and severity of these complications; methods of preventing ICU related complications and a rationale for nurse sensitive patient outcome indicators to drive clinical practice improvement.

Chapter Three - Review of action research in ICUs

Chapter three provides a systematic review of studies using the action research method in ICUs.

Chapter Four - Methods

Chapter four gives an overview of the research method, including the research design, data collection, data management, data analysis and ethical considerations.

Chapter Five - Phase 1: Assessment of organisational readiness

This chapter provides the findings of the environmental scan, a description of staff and patient characteristics in the study setting, nurses' perception of their professional practice environment, the potential for sustainability of the change process, and nurses' knowledge regarding prevention of the three ICU complications targeted in the INVEST Study

Chapter Six - Phase 2: Nurses perceptions of standardised assessment and prevention of ICU complications

Chapter six presents the findings of focus groups undertaken to ascertain nurses' perception of the intervention. This chapter includes a description of the study approach, participant recruitment, data collection process and recommendations.

Chapter Seven - Phase 3: Comparison of pre and post interventions findings

Chapter seven provides the findings from the evaluation phase. The results in Phase 3 are compared with those from Phase 1 to determine changes in staff perception of their professional practice environment, sustainability of change process, knowledge regarding prevention of three ICU complications and patient outcome data.

Chapter Eight - Phase Three: Sustainability of evidence-based practice

Chapter eight provides findings from the evaluation phase. In this phase, the results of the focus group are presented. The focus group findings reveal staff views of the change process and the impact on work culture.

Chapter Nine - Conclusion

This chapter integrates the findings from this study. All the three phase findings are integrated and their impact on current practice and knowledge described. The implications for policy, practice, research and education are also discussed. Figure 1.2 below is a diagrammatic summary of the study.

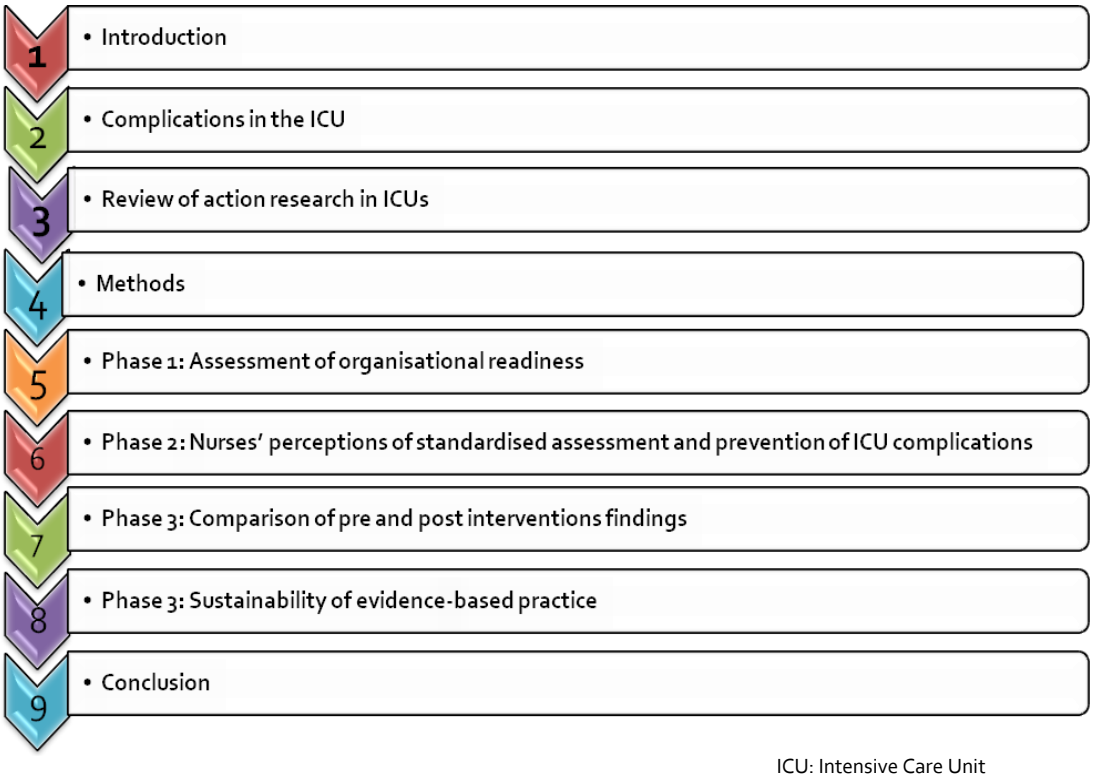

Figure 1.2 Thesis flow diagram

1.9 Summary

This chapter has provided a framework for the thesis and has introduced the background to the study, the research questions, aims and outline of the thesis. The purpose of the study has been to improve patient outcomes by evaluating the current nursing practice, identifying and sustaining the best practices in prevention of three complications in ICU. Adverse events in the ICU complicate the patient's recovery, increasing the length and costs of hospitalization as well as morbidity and mortality.[11-19] The following chapter provides a summary of the prevalence and management of VAP, CRBSI and PU in the ICU.

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CHAPTER TWO

COMPLICATIONS IN THE INTENSIVE CARE UNIT

CHAPTER 2
COMPLICATIONS IN THE INTENSIVE CARE UNIT

2.1 Introduction

Chapter 1 has described the importance of preventing complications in the intensive care unit (ICU). This chapter defines and describes the prevalence and severity of *ventilator-associated pneumonia* (VAP), *catheter related blood stream infection* (CRBSI) and *pressure ulcer* (PU) in the ICU. Diagnostic criteria are presented and strategies for preventing VAP, CRBSI and PU. The importance of nursing care and identifying and monitoring nurse-sensitive patient outcome indicators are presented. Practices in the study setting prior to the study are described as well as issues in the accuracy of baseline data.

2.2 Literature search

A literature search was conducted using the key terms *VAP, CRBSI, PU, ICU* and *quality improvement*. Databases were searched for information related to prevalence, severity and prevention of VAP, CRBSI and PU in ICU and also nurse-sensitive patient outcome indicators. The electronic databases Cumulative Index of Nursing and Allied Health Literature (CINAHL); Medline; Scopus and the World Wide Web using Google Scholar were searched. Inclusion criteria for the review were articles reporting VAP, CRBSI, PU prevention in the adult ICU. Studies published in languages other than English and paediatric populations were excluded. Titles and abstracts of papers identified through this initial search were scanned for relevance and the pertinent papers obtained. The lists of all articles obtained were then checked to identify further references for inclusion in the literature review.

2.3 Ventilator-associated pneumonia

Ventilator-associated pneumonia refers to pneumonia developing in mechanically-ventilated patients more than 48 hours (2 days) after intubation.[1, 2] It is one of the most frequent and costly hospital-acquired infections in the ICU with a prevalence of 10 to 70 percent.[3, 4] Among all of the hospital-acquired infections, VAP has the highest mortality rate of up to 60%.[5]

In Malaysia, surveillance by Hanifah and Mohd Yusof at the University Malaya Hospital ICU discovered that out of 51 hospital-acquired infections, 21 (41.2%) involved the respiratory tract.[6] The ICU-acquired hospital infection surveillance program 1998-1999 at the Malaysia National University Hospital by Rozaidi et al.[7] also found that more than half the patients (28 of 53) diagnosed clinically with VAP were confirmed with bronchoscopic aspiration and lavage (BAL). However, even this high proportion may be an underestimation of the actual incidence of VAP due to the unavailability of bronchoscopy to all admitted patients. A report for a multiple one-day prevalence study on VAP in 14 Ministry of Health Hospital ICUs from June to August 2004 found that 16.7% of 174 patients had VAP.[8] The 22% VAP detected in the study ICU as part of this surveillance project was considered to be above average. The actual prevalence of VAP may have been understated as the study was only a single-day point prevalence study.

In 2005, the Malaysian Ministry of Health (MOH) statistics showed pneumonia to be among the top six principal causes of death in its hospitals.[9] A surveillance in three ICUs in Malaysia also discovered that the major nosocomial infections were pneumonia followed by bacteraemia at 18.7% and 8.5%, respectively.[10] However, the Malaysian National Audits on adult intensive care units found that the incidence of VAP had decreased by over half, from 28.0 to 13.5 per 1000 ventilator days, in the six years from 2003 to 2008.[11] The recorded rate of VAP in the ICU studied was 26.2 and 29.7 VAP per 1000 ventilator days from 2003 to 2004. This number had dropped significantly for2005 to 2008 to 6.8 and 8.2 VAP per 1000 ventilator days respectively.[11] There were no data on infection-induced

mortality rates for patients in this audit. In December 2009, four VAP cases were identified in 91 patients admitted in this ICU over one month period.[12]

In Malaysia, management protocols and ventilator care bundles were introduced on 1st January 2007 in 14 ICUs. 'Bundles' is a term used to describe the grouping of evidence-based interventions and is commonly used as part of the quality improvement process and particularly associated with the collaborative methodology.[13, 14] Some of these protocols are focussed on preventing VAP and improving patient care.[15, 16] Although these protocols have been introduced in the ICUs, there has been no reporting on adherence with these recommendations or issues in implementation. Nevertheless, these protocols may have contributed to the halving of the rate of VAP in Malaysian ICUs.

The ventilator bundle provides evidence based strategies for patients who are mechanically ventilated. A number of international studies and quality improvement initiatives have involved implementation of a ventilator bundle which includes: head-of-bed elevation, daily interruption of sedation to reduce time on mechanical ventilation, deep vein thrombosis prophylaxis and peptic ulcer prophylaxis.[1, 14, 17, 18] Experts[19-21] speculate that improving patient care by coordinated teamwork may improve VAP rates, rather than any specific intervention. However, attributing causation to interventions which are complex is increasingly challenging.[22]

The Institute of Healthcare Improvement has suggested revising the oral care policy to include tooth brushing every 12 hours and suctioning of oropharyngeal secretions together with the ventilator bundle in order to improve VAP prevention.[23] A study[24] found that using the ventilator bundle including an oral care policy and subglotic suctioning significantly reduced the rate of VAP after 12 months. Implementation of a VAP bundle was reported to have improved the VAP rate even though the compliance rate was often less than 100%, especially in the early years of implementation.[18, 25] The use of oral antiseptic chlorhexidine gluconate and subglottic suctioning has also been an effective strategy for preventing VAP.[13, 26] Other interventions that may be considered include rotation of the bed and elevation

of the head of bed to 45 degrees, which were identified by Muscedere et al. [27] as beneficial in preventing VAP.

Strategies for preventing VAP are urgently needed, and there is no single foolproof solution. Mechanically-ventilated patients in the ICU are most frequently positioned with a small back rest elevation of 10 to 30 degrees.[28] This may be partly attributed to insufficient awareness of the benefit to elevate head of bed higher than 30 degree, disagreement about who is responsible for patients' bed positioning and certain difficulties in enabling and reinforcing such strategies.[29] A meta-analysis provides reliable evidence that mechanically-ventilated patients should not be placed in a supine position.[30]

A semi-recumbent position is a low-cost, easy intervention, and may be a more practical and tolerable approach than a rotational bed or prone position.[31] Maintaining patients receiving mechanical ventilation or being enterally fed in a 30- to 45-degree semi-recumbent position, particularly during enteral feeding, continues to be strongly recommended based on the VAP reduction in randomized studies.[1, 32-34] The odds of developing clinically-diagnosed VAP were significantly lower among patients in the semi-recumbent 45-degree position than those in supine position (OR = 0.47; 95% CI, 0.27-0.82; 337 patients).[30] In a sub group analysis of the incidence of microbiologically-documented VAP, the length of stay in the ICU and the duration of mechanical ventilation were moderately improved for patients in the semi recumbent position.[30]

Currently, in the study setting for the INVEST study, mechanically-ventilated patients are positioned to only 10 to 30 degrees elevation to reduce endotracheal aspiration of oropharyngeal contents. Considering the technical difficulties prohibiting routine use of the prone position as a VAP preventing measure, semi-recumbent positioning at >30 degrees should be standard practice in the ICU.[13, 18, 20, 30, 34-36]

The Malaysian Ministry of Health has adopted the VAP diagnostic criteria from the Center for Disease Control and Prevention in all Ministry of Health hospitals as provided in the Table 2.1. The diagnosis of VAP in this study was made based on the CDC diagnostic criteria following clinical assessment and diagnosis by a medical doctor, review of culture results and radiographic evidence.

Table 2.1 Ventilator-associated pneumonia diagnostic criteria

Ventilator- Associated Pneumonia Diagnostic Criteria

Two or more serial chest radiographs with at least **one** of the following

- New or progressive and persistent infiltrate
- Consolidation
- Cavitation

Note:

In patients without underlying pulmonary or cardiac disease (e.g. respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary oedema, or chronic obstructive pulmonary disease) **one** definitive chest radiograph is acceptable.

Sign / Symptoms

For any patient at least **one** of the following

- Fever (>38°C) with no other recognized cause
- Leukopenia(<4000 WBC/mm^3) or leukocytosis(≥12,000 WBC/mm^3)
- For adult ≥70 years old, altered mental status with no other recognized cause

and

At least **two** of the following:

- New onset of purulent sputum or change in character of sputum or increased respiratory secretions or increased suctioning requirements
- New onset or worsening tachypnea
- Rales or brochial breath sound
- Worsening gas exchange eg:
  - Oxygen desaturation
  - PaO_2/FiO_2 ≤240
  - Increased oxygen requirements
  - Increased ventilator demand

Centers for Disease Control and Prevention[37]

2.4 Catheter related blood stream infection

Central venous catheterisation is commonly used in the ICU to achieve venous access for vasoactive infusion, parenteral nutrition, monitoring of patient hemodynamic status and temporary transvenous cardiac pacing.[38] Insertion of a central venous catheter (CVC) exposes patients to adverse events such as arterial puncture, haemorrhage, pneumothorax, neck or mediastinal hematoma and infection.[38-41] As many complications can occur when inserting a CVC, the risk of CRBSI is high in critically ill patients due to the catheter being frequently placed in emergency circumstances, repeatedly accessed daily and often fixed for extended periods.[42-44]

Insertion of CVC disrupts the skin integrity and so increases the risk of infection of the blood stream. The Center for Disease Control and Prevention[45] has defined catheter-associated blood stream infection as:

> *"Vascular access device that terminates at or is close to the heart or one of the great vessels. An umbilical artery or vein catheter is considered a central line. BSI is considered to be associated with a central line if the line was in use during the 48-hour period before development of the BSI. If the time interval between onset of the infection and device use is >48 hours, there should be compelling evidence that the infection is related to the central line."*

And catheter related blood stream infection as:

> "*Bacteremia/fungemia in a patient with an intravascular catheter with at least one positive blood culture obtained from a peripheral vein, clinical manifestations of infections (i.e., fever, chills, and/or hypotension), and no apparent source for the BSI except the catheter. One of the following should be present: a positive semiquantitative (>15 CFU/catheter segment) or quantitative (>10^3 CFU/catheter segment catheter) culture whereby the same organism (species and antibiogram) is isolated from the catheter segment and peripheral blood; simultaneous quantitative blood cultures*

with a ≥5:1 ratio CVC versus peripheral; differential period of CVC culture versus peripheral blood culture positivity of >2 hours. "

CRBSIs are one of the most common nosocomial infections in ICU patients, with approximately 80,000 cases in American ICUs annually.[46, 47] The National Nosocomial Infection Surveillance System (NNIS) reported rates of 2.2 to 7.3 infections per 1,000 catheter-days.[48] CRBSI can prolong length of stay and may lead to increased in-hospital mortality and excess cost of hospitalization.[49-51] A study by Laupland et al.[52] showed a mortality rate of 45% for patients with ICU-acquired BSI compared with 21 % for those without. In Argentina, Rosenthal et al.[53] found CRBSI associated with an average excess cost of US$4888 and an extra stay of 11.9 days per episode. Reducing CRBSI in ICU patients will save costs, reduce hospital stay, and improve outcomes.[54] In Malaysia there are limited data on this issue and also infection-induced mortality for patients caused by CRBSI. A survey of 656 CVCs in 496 patients in the ICU of Hospital Sultanah Aminah in Johor Malaysia found CRBSI diagnosed in 38 catheters, giving an incidence of 9.43 per 1,000 catheter-days.[55] CVCs inserted in the ICU caused the highest infection rate (9.4%) compared to those inserted in the ward (2.8%) and operating theatre (1.4%).[55] A higher incidence of bacteraemia was also noticed among patients treated with central venous lines in a surveillance of three adult ICUs in Malaysia.[10]

A surveillance study on nosocomial infection associated with usage of devices conducted in three ICUs in Malaysia found that bacteraemia was found in 8.5% (*n*=11) of the patients within an average duration of 10.0 (5.0) days in ICU.[10] They found that the bacteraemia rate was 8.9 per 1,000 patient-days. Common organisms cultured were Gram negative organisms such as *Escherichia coli (n=1), Klebseilla pneumoniae* (*n*=1), Extended Spectrum Beta Lactamase *Klebseilla pneumoniae (n=2)* and *Acinetobacter species* (*n*=2) and the Gram positive organisms showed methicillin-resistant *Staphylococcus aureus* (MRSA) (*n*=3) as the common causative organism.[10]

Central venous catheters have become essential for administering lifesaving therapies to ICU patients. The corollary is that they also provide a route for infection if aseptic conditions are not maintained. Several factors contribute to the risk of infection, such as cutaneous colonization of the insertion site, moisture under the dressing, prolonged catheter time, technique of care and placement of the central line.[56] Several studies found that CVCs inserted into the femoral vein had the highest rates of catheter colonization; the jugular vein gave intermediate rates and the subclavian vein the lowest rates.[38, 41, 47, 54, 57-59] A prospective study in 13 ICUs in Turkish hospitals found that the common organisms causing infection were *Acinetobacter spp*. (23.2%), *S. aureus*, (19.6%), *Enterobacteriaceae* (12.2%), *coagulase-negative Staphylococcus* (11.0%), *Pseudomonas spp. (*3.4%) and other micro-organisms (7.3%).[60] *Acinetobacter* was also found causing *Acinetobacter* blood stream infection in a prevalence study at a university hospital in Malaysia.[61] They reported *Acinetobacter* blood stream infection as higher than other-gram negative blood stream infections for patients with CVC 43 (74.1%) and 36 (62.1%).[61]

The recommendations for prevention of CRBSI include good hygiene, especially proper hand washing, maximal barrier precaution, application of skin-antiseptic and use of antibiotic-coated catheters.[47, 59, 62, 63] Maximal barrier precautions include wearing a mask, sterile gown and gloves, and covering the patient with large sterile drape for all CVC insertions.[47, 59, 63-65] Two percent (2%) chlorhexidine gluconate (CHG) is recommended as the first-line skin antiseptic to be applied before CVC insertion.[62-64 47] The aim of these preventive actions is to reduce CRBSI in the ICU. Although sustaining the prevention strategies is challenging, some studies have found them successful in reducing catheter-related infections.[62, 64-66]

In Malaysia, Ministry of Health hospitals do not routinely do quantitative and semi quantitative blood cultures but only use a qualitative blood culture method, including the hospital where this study was conducted. A qualitative central blood culture performed through the CVC appears to be important in diagnosis of a CRBSI in the ICU.[67] A study found an exact diagnosis of CRBSI could be made in 16 of the 17 patients, who had positive results of culture of a blood sample from the CVC at least two hours earlier than they had a positive result of a peripheral blood culture.[68] In hospital without quantitative blood cultures method the measurement of differential time to positivity was recommended to facilitate the diagnosis of CRBSI.[67, 69] In this study blood withdrawn from the central line was used for culture when infection was suspected based on the CDC diagnostics criteria. After two hours, the peripheral vein blood was withdrawn for another culture.

The positive qualitative blood culture results from both the central venous catheter lumen and peripheral vein which contained the same organisms were used to confirm the diagnosis of CRBSI in this study. The criteria for this study were developed following consultation with the intensivist and microbiologist in Malaysia. The Malaysian Ministry of Health adopts CRBSI diagnostic criteria from the Center for Disease Control and Prevention in all Ministry of Health hospitals as provided in Table 2.2.

Table 2.2 Catheter related blood stream infection diagnostic criteria

Catheter Related Blood Stream Infection Diagnostic Criteria
Criteria I
Patient has a recognized pathogen cultured from **one** or more blood cultures **and** The pathogen cultured from the blood is not related to an infection at another site.
Criteria II
Patient has at least **one** of the following signs or symptoms: - Fever >38° C - Chills - Hypotension, **and** Sign and symptoms and positive results not related to infection at another site **and** Presence of at least **one** of the following: Common skin contaminant (e.g., diphtheroids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) cultured from two or more blood cultures drawn on separate occasions. Common skin contaminant (e.g., diphtheroids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) cultured from at least one blood culture from a patient with an intravascular catheter. Positive antigen test on blood (e.g., *Hemophilus influenzae, Streptococcus pneumoniae, Neisseria meningitides,* or group B streptococcus). Centers for Disease Control and Prevention[45]

2.5 Pressure ulcer

National Pressure Ulcer Advisory Panel from the United States[70] defined PU as:

> *"A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction. A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated."*

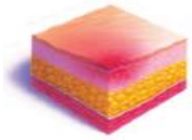
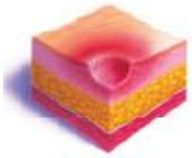
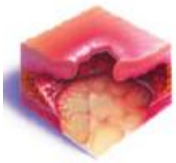
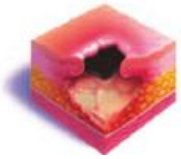
Internationally, PU is recognised as an adverse outcome of admission to a health care facility.[71] Critically ill patients are at a higher risk to develop PUs than patients in general care due to pathophysiological changes and immobility. The incidence reported is up to 20% among the critically ill.[71, 72] The occurrence of PU interferes with recovery, lengthens the hospital stay, causes extreme pain and discomfort while increasing the risk of infection, and may even result in death.[73] Moreover, the underlying diseases of many patients in ICU, such as diabetes mellitus or being in shock, can affect their tissue perfusion and hemodynamic instability; therefore, they have increased risk of developing PU.[72] Pressure ulcers markedly affect the patient's quality of life, morbidity and mortality, and account for considerable direct costs in a health care economy.[71]

A cross-sectional point prevalence study in all specialties ICUs in the Netherlands found that out of 850 patients studied, 28.6% and 28.8% developed PUs in 1998 and 1999, the highest percentage in patients with an infection including sepsis.[74] A PU prevalence survey in the United States also reported overall rates in adult ICUs in 2009 of 16.6% (n = 1,842) in surgical ICUs and 20.7% (n = 1,940) in medical ICUs.[75] In Malaysia, there is limited data on the prevalence / incidence of PUs in ICUs, and also in the particular ICU studied. There was no PU reported in the study setting for the INVEST Study in 2007 and 2008.[11] In 2009, the Malaysia

Registry of Intensive Care[76] reported PU incidence of zero to 31.6 with mean of 7.7 per 1,000 ICU days in 2008 to 2009. In the study setting, PU was reported at 0.3 per 1,000 ICU days in 2009. The incidence of PU varies from one healthcare setting to another, with previous studies of PUs in intensive care settings giving values of 4 to 49% (prevalence) and 3.8 to 12.4% (incidence),[77] which suggests in Malaysia there is a lower incidence than in other countries. The lower incidence rate may be attributed to nurses' limited understanding of the standard measures for grading, assessing and reporting procedures PU. Furthermore, prior to the study, there was no specific PU assessment and grading tool used in the study ICU. (ICU Ward Manager, Personal communications, 10 November 2009) The assessment is commonly done collectively with other nursing care procedures, such as during a bed bath. Therefore, during busy times the assessment can be overlooked.

Prior to the study a lack of understanding regarding PU grading was evident. For example, nurses failed to consider erythema as a stage one PU only recognising skin breakdown as significant. (ICU Ward Manager, Personal communication, 10 November 2009) Therefore, this ICU may have underestimated the PU incidence because of the nurses' poor understanding of staging skills. This may explain the low number of PU in the National ICU Audit from 2007 to 2009. Screening for the risk factors of PU on admission to the ICU and strict preventive treatment are important to decrease the incidence of PU.[73, 78] This study used the National Pressure Ulcer Advisory Panel (NPUAP) Grading System[70] (Table 2.3).

Table 2.3 Guidelines for staging of pressure ulcers

Stage	Definition	Further Description
 SDTI	Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue	Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid exposing additional layers of tissue even with optimal treatment
 1	Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area	The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones. May indicate "at risk" persons (a heralding sign of risk)
 2	Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister	Presents as a shiny or dry shallow ulcer without slough or bruising.* This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation. *Bruising indicates suspected deep tissue injury
 3	Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunnelling	The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable
 4	Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling.	The depth of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable
 Unstagable	Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed	Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as "the body's natural (biological) cover" and should not be removed.

SDTI: Suspected deep tissue injury **National Pressure Ulcer Advisory Panel[70]** ***Used with Permission***

Patients in ICU have limited functional ability. Patients often experience loss of sensory perception, generally resulting from anaesthetics and sedative drugs, causing a lower level of consciousness and cutaneous sensation.[79] Pressure ulcers are an additional comorbidity that threatens patients who are already physiologically compromised. Identification of patients at risk of developing PU not only depends on the professional's clinical ability, but also on measuring instruments which have appropriate predictive, sensitivity and specificity values.[80] This study used the Waterlow Pressure Ulcer Risk Assessment Scale[81] for diagnostic criteria in Figure 2.1. The Waterlow was selected because the sensitivity and specificity of the scale on different patient groups,[79, 82-84] and suitable for patients in critical care settings.[85] According to Papanikolaou et al.[84] the Waterlow scale has satisfactory predictive ability. This scale provides reliable information for nurses to identify high risk patients earlier[85] than the current ICU practice.

The Waterlow scale consists of 10 categories (build/weight and height, appetite, continence, sex/age, skin type visual risk area, mobility, special risk, neurological deficit, major surgery/trauma, medication and malnutrition screening tool), each containing several subscales. Each subscale is allocated a 'risk score' ranging from 0 (the most favourable) to 3/4/5/6/8 (the least favourable). A patient is deemed *at risk* if the total score is between 10-14; at *high risk* if the total score is between15-19 and at *very high risk* if the total score is over 20 as identified in Figure 2.1

Waterlow Pressure Ulcer Risk Assessment Scale				(Affix patient identification label in this box)	
BUILD/WEIGHT FOR HEIGHT		**APPETITE**		**CONTINENCE**	
Average (BMI: 20-24.9)	0	Average	0	Complete or catheterised	0
Above average (BMI: 25-29.9)	1	Poor	1	Urine incontinent	1
Obese (BMI: >30)	2	Tube/fluids only	2	Faecel incontinent	2
Below average (BMI: <20)	3	Nil by Mouth/anorexic	3	Urinary + faecel incontinent	3
SEX / AGE		**SKIN TYPE VISUAL RISK AREAS**		**MOBILITY**	
Male	1	Healthy	0	Fully	0
Female	2	Tissue paper	1	Restless/Fidgety	1
14-49	1	Dry	1	Apathetic	2
50-64	2	Oedematous	1	Restricted	3
65-74	3	Clammy, Pyrexia	1	Bedbound/traction	4
75-80	4	Discoloured Grade 1	2	Chairbound e.g. wheelchair	5
≥81	5	Broken/Spot Grade 2-4	3		
SPECIAL RISKS		**NEUROLOGICAL DEFICIT**		**MAJOR SURGERY / TRAUMA**	
Terminal cachexia	8	Diabetes, MS, CVA	4-6	Orthopedic / spinal	5
Multiple organ failure	5	Motor/Sensory	4-6	On table> 2 hrs#	5
Single organ failure (resp, renal, cardiac, liver)	5	Paraplegia	4-6	On table> 6 hrs#	8
Peripheral vascular disease	5	**MEDICATION**		**SCORE**	
Anaemia (Hb<8)	2	Cytotoxics	4	At risk	10+
Smoking	1	Steroids		High risk	15+
		Anti-inflammatory		Very high risk	20+
		Anti-coagulant			
				Total Score:	
#Scores can be discounted after 48H provided patient is recovering normally					
Malnutrition Screening tool (MST) – Circle scores and add for a total score					
A. Has the patient lost weight recently without trying?		B. How much Weight has the patient lost?		C. Has the patient been eating poorly because of a decreased appetite?	
Yes - Go to question B No - Go to question C Unsure - Score 2 and go to question C		0.5-5.0kg - Score 1 5-10.0kg - Score 2 10.0-15.0kg - Score 3 > 15.0kg - Score 4 Unsure - Score 2		No - Score 0 Yes - Score 1 **Nutritional Score:**	
Nutrition score if > 2 refer for nutrition assessment and intervention					

Figure 2.1 Waterlow pressure ulcer risk assessment

Pressure ulcers cause unnecessary pain and suffering to patients and are associated with increased morbidity and even mortality.[86] Recovery of patients with PU is delayed, as demonstrated by their increased length of hospitalization and increased health-care costs.[87] The PU incidence is one of the quality signs of health centers, and PU appears the most in patients in ICUs.[73, 77] The presence of a PU creates a detrimental effects psychologically, physically and clinically to patients, carers and their families.[88] Pressure ulcers are associated with significant economic burden, and costs.[89] More research in PU prevention in hospitals had been done internationally.[80, 88, 90, 91]

A systematic review of 59 randomised control trials found that using support surfaces, repositioning of patient, optimising nutritional status and moisturizing of sacral skin are the most promising strategies in prevention of PUs.[92] Implementing evidence-based protocols for prevention of PU help practitioners make decisions in accordance with the current state of knowledge, and they also serve to establish more consistency in practice.[80, 86, 88, 90, 91] Regular skin care and nursing interventions have a great influence on the reduction of PU prevalence in ICU patients.[77, 90, 91, 93] Moreover, there may be a gap between theory and practice in the prevention of PUs in the study setting and also national ICUs as a whole as evidenced by the low number of PUs documented in patients in this ICU compared to the numbers in ICUs abroad. More research on PUs in intensive care settings is needed on the different prevention strategies to address this gap between theory and practice.

2.6 Prevention of ICU related complications

The four most common adverse events occur whilst in hospital are medication errors, nosocomial infection, pressure ulcers and injury related to falls.[94, 95] In the United States the Institute of Medicine reported that at least 44,000 to 98,000 people die a year in hospital as a result of errors that could have been prevented. Beyond the cost of human lives, preventable medical errors are estimated to result in a total cost of US$17 to 29 billion a year in hospitals nationwide.[96] The

hospital, including clinicians and nurses in the ICU, should be held accountable for key patient safety goals.

There are limited data on the cost of treating medical errors, nosocomial infection, PU in Malaysian ICUs. The goal of prevention strategies is to reduce complications in patient care. Many of the strategies for preventing VAP, CRBSI and PUs are common sense, for example, hand washing and core nursing care activities including positioning. Although implementation is challenging, many studies have demonstrated success.[30, 36, 64, 91, 97, 98] Studies also found that in order to sustain reduction of ICU complication will require a continued multidisciplinary effort.[66, 99, 100] This study has sought to develop multifaceted approaches rather than focus on a single condition for clinical practice improvement. It is hypothesised that this approach, linking common risk factors, may be effective in sustaining behaviour change in the longer term.

Oxman and colleagues[101] undertook a systematic review of 102 trials to support a variety of quality improvement strategies to improve the delivery of health care services. They found that there were no "magic bullets" for provider behaviour change however a range of interventions could lead to behaviour change especially those using multifaceted strategies for promoting change. But no single intervention was always effective for changing behaviour.[101, 102] Instead of using a single approach, multifaceted interventions combining more than one intervention tended to be more effective when targeting different barriers to change.[101-103]

2.7 Nurse-sensitive patient outcome indicators

Nurses must be able to identify and document the outcomes that are influenced by nursing care. As a result, there is a need to describe and measure the impact of nursing care on patient outcomes.[104] Nurse-sensitive patient outcomes (NSPO) or nurse-sensitive outcome indicators can be defined as patient or family caregiver states, behaviours or perceptions that are sensitive to nursing interventions.[105] These indicators are crucial in measuring the impact of care

delivered by nurses. A comprehensive assessment of outcomes sensitive to nursing care in the ICU is important from the perspective of quality of care and patient safety. Nurses represent the largest component of the health care workforce and they play an important role in detecting and/or mitigating adverse events. All ICU nurses are expected to provide comprehensive, compassionate, complex, technologic care without causing harm to patients.[94] They also have been challenged to provide evidence of the extent and quality of their contributions to patient outcomes in order to demonstrate the quality of their care. Many have called for nurses to take professional control of their practice and use evidence-based strategies for clinical practice improvement.[106-108] Subsequently, they need to implement and evaluate strategies that are appropriate to their local context and cultural considerations in order to control their practice. Consequently, nurses need to examine their care practices and their processes around care to reduce the chances of adverse events so that they can create a patient-safe environment within the ICU.

The majority of strategies to reduce VAP, CRBSI and PU complications fall principally within the context of basic nursing, mobility, and hygiene care. However, some ICU nurses may have the notion that hygiene and mobility have much lower priority than titrating vasoactive infusion, administering of drugs or monitoring of hemodynamic status.[94] By placing evidence-based hygiene and mobility strategies in a comprehensive program designed to reduce adverse events in ICU it can help move these practices to a higher priority as perceived by nurses in the list of care activities.[94] In view of the fact that nurses play a key role in the delivery of health care, it is crucial that they critically evaluate their practice and play a critical role in the assessment of healthcare effectiveness. Thus, this study will focus on providing the rationale and evidence to support changes in key nursing care practices to reduce adverse events in the ICU.

2.8 Summary

This chapter has provided an overview of issues impacting on the prevention of three major ICU complications. This has included prevalence rates, methods of assessment and outcome measures. Effective nursing care can help to minimise VAP, CRBSI and PU complications if the recommended practices are integrated into routine nursing practice. The purpose of the prevention is to reduce complications during patient care by implementing core nursing activities including hand washing. Prevention of these three major complications were demanding and sustaining the practice is more challenging and requiring multidisciplinary effort. A review of action research was undertaken as part of the thesis to inform the action research project undertaken in ICU as part of this thesis. The following chapter provides findings from a systematic review of action research in the critical care settings.

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CHAPTER 3

REVIEW OF ACTION RESEARCH IN INTENSIVE CARE UNITS

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3.1 Introduction

Chapter 2 has provided an overview of ventilator-associated pneumonia (VAP), catheter-related blood stream infection (CRBSI) and pressure ulcer (PU) complications in the intensive care unit (ICU). This chapter describes the historical background of action research, methodological considerations and challenges associated with action research. In addition a review of action research in ICU is presented.

3.2 Study design

As part of the INVEST Study design reported in this thesis, an action research approach incorporating the Clinical Practice Improvement Model was adapted from the Institute of Health Care Improvement, USA.[2] This model was used to address VAP, CRBSI and PU in the ICU. This model is known as a powerful tool to accelerate improvement in a health care organisation.[2] As part of the INVEST Study, this approach was embedded in a formalized action research process. This action research project incorporated a concurrent mixed methods approach for both summative and outcome evaluation of the INVEST project. Figure 3.1 demonstrates the dynamic and iterative process of action research involving cycles of planning, acting, observing and reflecting.[1]

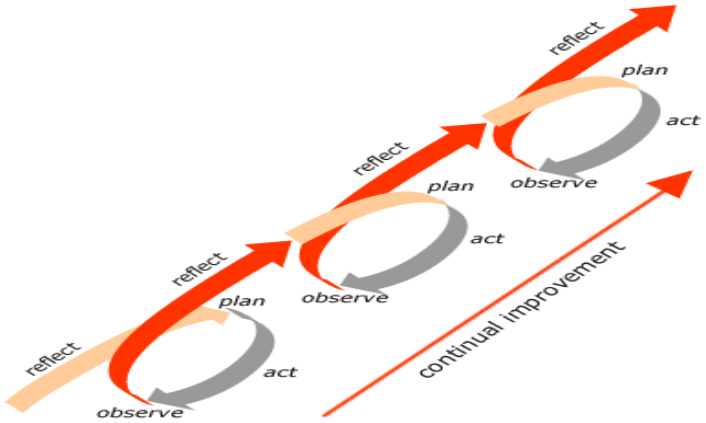

Figure 3.1 Action research diagram *Used with permission*[1]

3.3 Historical background of action research

The foundations of action research are attributed to the social psychologist Kurt Lewin (1890-1947) in the 1940s, who used this inclusive, enabling model to solve social conflicts in minority groups.[3] Lewin wanted to know if people could, through self-education, enable themselves to improve their social situation. The significant aspect of action research is that, through belief, people are more likely to act on decisions made in a group - rather than on decisions made alone - to solve practical problems.[3] Gunz[4] proposed that Lewin's colleague, Jacob Moreno, a social philosopher who shared students with Lewin, had influenced Lewin. Jacob Moreno sought to integrate theory and practice by perceiving researchers as social investigators.[4] There is a wide range of disciplines, including social science, education, psychology and nursing, in which writers have contributed to the evolution of action research and in part explains the disparity in approaches.[5]

Empowerment of individuals and organisations to challenge traditional boundaries in respect of methods and significantly power relationships is a central tenet of action research.[5] This research approach can be readily adopted by health care providers to improve service delivery and quality of care.[6] Part of action

research lies in its ability to bridge the gap between theory, research, practice and scientific methods[7, 8] which can influence practice positively while generating data that can be shared with a wider audience and produce tangible benefits.[8] The flexibility of action research has enabled it to be used in a variety of health and education settings to effect change.[5] This research method assists in understanding and addressing complex problems or facilitating the development of relevant and appropriate practices, services and organisational structures.[5]

The cyclic process of action research makes it most suitable to fulfill the needs of organisations yearning to drive change within their operating environment. Action research methodology is also efficient in developing better practices across inter professional boundaries and across the care continuum.[5] Achievement in action research ought not only be judged exclusively on the amount of changes made and implementation of solutions, but also from the knowledge transfer and shared learning that occurs during the research process.[9] Frequently, during these cyclic processes novel and unexpected solutions to specific problems emerge and these are also important indicators of accomplishment.[9]

3.4 Challenges associated with action research

Action research has been identified as a useful framework for researching innovation as well as having a realistic evaluation method[10] particularly suitable to identifying problems in clinical practice and developing solutions to improve the practice.[11] A major characteristic of action research is the continuous interaction between research, action, reflection and evaluation.[12] As well as generating new knowledge, an important aspect of action research is empowerment and engagement.[5] Within this study strategic initiatives will be undertaken to promote nurses' control over their own practice within the context of a multidisciplinary team. This will be through providing information and strategies within a collaborative framework. The researcher will work with the project team to develop and evaluate strategies to promote adherence with evidence-based practice recommendations.

The potential of action research is to generate new knowledge, improve clinical practice and patient outcomes with collaborating, participating and empowered healthcare staff. Action research is a method to integrate the perspectives of theory, research and practice[8, 13, 14] and provide a framework for closing the evidence / practice gap. A systematic review found only limited articles on action research in the ICU, and that they had little or no focus on patient outcome.[15] The majority of them focussed primarily on process and formative evaluation, not in sustaining the practice or improving clinical outcomes.[15] The ICU is a complex and multifaceted organisational structure;[16] therefore, the use of action research in this complex environment may be a useful method to engage in patient management issues.

3.5 Systematic review of action research in the intensive care setting

This review was undertaken to provide an overview of findings and a synthesis of the results of primary studies in order to inform the action research project undertaken as part of this thesis.[17] The search strategy and process of retrieval as the first step in a systematic review included the collection of relevant articles from a range of resources consisting of electronic databases, libraries, journals, conferences, dissertations and manual sources, such as archival materials and government reports[18, 19] Searches of the electronic databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL) 1982- June 2009; Medline 1950- June 2009; Embase 1980- June 2009; PsycINFO 1806-June 2009; Scopus 1996- June 2009 and the World Wide Web using Google Scholar, Scopus and Mednar search engines were undertaken using MeSH key words including: *action research, health care research, health services evaluation, medical care research, research, health services research, medical care* and *intensive care unit*. Reference lists of retrieved articles were also reviewed for additional studies.

Articles were considered suitable for inclusion if they reported primary data using action research in the adult ICU. All studies were reviewed using a critical appraisal tool adapted from resources used in the Critical Appraisal Skills

Programme (CASP).[20] For each included study, data on methods, setting, findings, strength and weaknesses of the approach were extracted onto standard data collection forms by Kim Lam Soh and Patricia M. Davidson. In the event of disagreement, a third reviewer provided clarification. The appraisal tool sought to document study characteristics, barriers and facilitators to action research implementation and the process and outcome measures identified. Due to the heterogeneity of the studies and the project aim to report on action research in ICUs, formal meta-analysis techniques were not applied.

3.6 Findings of the review

The initial search found 2,020 articles. The retrieval yields, according to specific data bases, are shown in Table 3.1.

Table 3.1 Number of articles retrieved from databases

Database	Duration	n
CINAHL	1982 - June 2009	186
Medline	1950 - June 2009	722
Embase	1980 - June 2009	420
PsycINFO	1806 - June 2009	692
Total		**2020**

Out of the 2,020 articles identified, 1,825 were excluded based upon the search criteria. Only 195 potential studies were identified to be included in the review. After reviewing the full articles, only seven matched the inclusion criteria. The majority of these articles were excluded as they did not use an action research method in their project, rather using other types of research methodology such as survey, literature review, case study, audit, observational study or medical record review. One report was rejected as the study did not focus exclusively on the ICU. Hand searching subsequently found another 14 articles, giving a final number of 21 for the review. The hand searching involved reviewing references from the seven articles identified. The schemata for the article selection process are summarised in Figure 3.2.

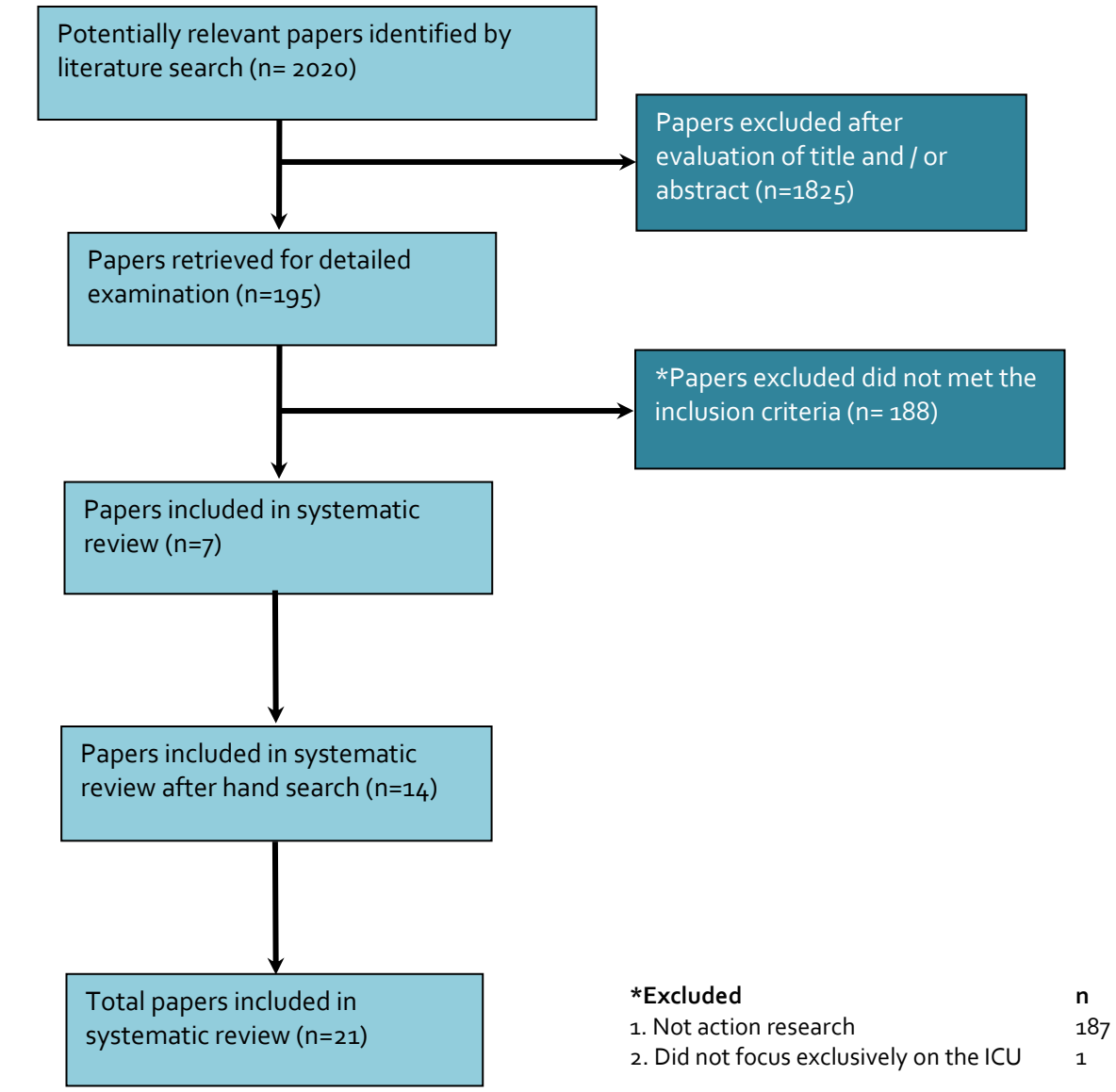

Figure 3.2 Flowchart of study selection process

3.6.1 Study location

Twelve (57.14%) of the studies were conducted in the UK,[21-31] two in Thailand[32, 33] and one each in Australia,[34] New Zealand,[35] Finland,[36] USA[37] and Switzerland.[38]

3.6.2 Types of action research and research methods

More than half (57.1%) of the studies used action research, followed by collaborative (19.1%) and participatory action (14.3%) research. Another action research design reported was emancipatory action research and one study did not indicate the type of action research used (Table 3.2). The studies included in the review used a range of research approaches, including questionnaire, observation, group presentation, audit, workshop, interview, reflective conversation and focus group discussion. All of them focussed on addressing problems and challenges in the clinical setting, includes *Negotiation of care with family members*[35] and *improving patient and relatives' information needs in the ICU,*[31] *Strategies to maximise patient dignity in the ICU,*[39] *The extent of practitioners exposed to evidenced-based practices and their ability to work in partnership with patients* [21] *Development of assessment tools to aid nurses in pain assessment for critically ill patients,*[29] *Improving staff knowledge and care for critically ill patients,*[38] *Improving nurses' decision making on dressing selection,*[30] *Nurses' perceptions of family-focused nursing,*[34] *Enhanced nurses' capacity to wean patients from mechanical ventilation,*[32] *Reasons why nurses choose not to undertake clinical supervision in the ICU,*[22] *Nursing care plan,*[26, 36] *Sedation scoring system,*[25] *oral care and hand hygiene practice,*[23, 28] *Quality improvement program to prevent ventilator-associated pneumonia,*[33] *Advanced practitioner / consultant roles,*[24, 27] *End-of-life care*[37]and *ICU practice environment.* [40, 41]

Table 3.2 Studies undertaking action research in intensive care unit

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Kite[23] 1995	Why do nurses do what they do for mouth care? What factors will facilitate or inhibit a change to research-based practice	Action research	Observation Interview In-service teaching Support programme	3	10 nurses	Only one of 10 nurses used a toothbrush to clean her patients' teeth. Three themes emerge from interview knowledge and practice, nurses need' and concerns, and environment influences Post-teaching results showed the themes of knowledge and practice and nurses' needs and concern had merged.	Many nurses were confident that tooth brushing an intubated patient was not a threat to patient's safety. Appropriate learning environment can help facilitate adoption of research-based practices. System identification of opinion leaders could be targeted with information and skills training in order to promote diffusion of innovation to the advantage of research implementation in nursing practice.
Manley[24] 1997	How the staff felt about advanced practitioner/ consultant nurse post?	Action research	Diary Focus group discussion	1	Not stated	Three influences were identified as essential prerequisites for successful operationalization of the advanced practitioner/ nurse consultant role	A conceptual framework highlighting implications to be considered in preparing advanced practitioners/consultant nurses was developed.
Butler[28] 1998	Can educational programme improve practice of hand hygiene?	Action research	Pre- and post-non participant observation Educational programme	3	Pre-education: 45 nurses 31 doctors 19 physiotherapist 5 porters Post-education: 50 nurses 33 doctors 16 physiotherapists 1 porter	There was no difference in hand hygiene practice for nurses and physiotherapists after education program. The doctors showed the most improvement in practice.	The education program had limited value to healthcare workers in the intensive care unit.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Saggs[25] 1998	Is published sedation scoring tools suitable for use in the studied ICU?	Action research	Multidisciplinary review Questionnaire Interview	3	6 nurses 3 registrars 1 ICU consultant 1 unit pharmacist Interview: 10 nurses 3 doctors	Bloomsbury scale favoured by the majority of staff because it was able to differentiate between 'roused by movement' and 'roused by pain' than other sedation scales. Therefore, it is thought to be a more sensitive sedation scoring scale.	Increase awareness related to sedation practice and scoring system.
Fawcett[26] 1998	Is the current care plan promoting good care plan practice? Is changing of care plan tool bringing about an improvement in care plan practice?	Action research	Questionnaire Focus group discussion	4	41 nurses invited to take part in each stage of the study 28 nurses completed the questionnaire	The care plan was not used as a care plan at the beginning of the shift. Original care plan able to guide the nurses but limited their critical thinking in planning patient care. New care plan found to be time consuming to fill in.	Nurses relied on verbal report from previous shift to care for patient without referring to the care plan. The pre-printed care plan is a useful teaching tool for new staff and student nurses.
Manley[27] 2000	How a consultant nurse facilitates the development of nurses and nursing to benefit patients and their families.	Emancipatory action research	Unstructured interview	1	Senior staff working outside the unit Specialist staff Primary team leaders 3 staff left unit at early stage	The culture in action was the same as the espoused culture such as being people centred, providing support, enabling development, active participation and devolved decision making.	The attribute of an effective organizational culture in a health care setting has explicit link to strong nursing leadership and outcomes.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Pyykko et al.[36] 2000	What type of nursing diagnoses describe: Patient health problems caused by onset, process of illness, treatment and the experiences resulting from them in ICU environment? Patients' relatives or significant other health problems due to patients' illness and treatment in ICU environment? What factors are related to nursing diagnoses? How can nursing diagnoses be classified?	Action research	Questionnaire Presentation Group Discussion Oral inter-shift report Content analysis	2	14 nurses first phase 34 nurses second phase 17 patients	Reclassification of nursing diagnoses for patient in ICU. Scoring for severity of patient health problem reduced from 5-point to 4-point scale.	Development of nursing diagnoses compatible with the goals of three intensive care units.
Rubenfeld & Curtis[37] 2001	What research needs to be done to improve end-of-life care to patients in ICU?	Not stated	Group discussion Group presentation	1	44 health care workers in all disciplines: Critical care medicine Palliative medicine Medical ethics, Medicine Surgery Nursing Social worker Chaplains	Research questions related to end-of-life care in ICU developed.	Outlining unanswered questions related to end-of-life care is first step to improve care for dying patients in ICU.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Turnock, & Kelleher[39] 2001	How to maximise patient dignity in the ICU?	Collaborative action research	Non participating observation Focus group discussion Audit	3	124 exposures 5 nurses 1 physiotherapist 1 radiographer 1 senior anaesthetist	Most exposures happened during technical procedures. Need to maximise physiological assessment may limit the extent to which patient dignity can be promoted. The need to compromise patient dignity in ICU is unfortunate consequence of critical illness. Practice protocols on maintenance of patient dignity developed.	Need for education to increase staff awareness in maintaining patient dignity in ICU.
Blenkharn et al.[29] 2002	How to improve pain assessment tool for nurses in ICU?	Action research	Feedback from nurses about the tools Teaching session Focus group	2	Not stated	Development of pain assessment tools to aid nurses in identifying severity of pain in unconscious patients.	The unit has an assessment tool which nurses are comfortable with and able to incorporate into their patient pain assessment.
O'Riordan[22] 2002	Why nurses choose not to undertake clinical supervision?	Action research	Pre-workshop Interview	2	12 nurses	Lack of involvement in clinical supervision identified. Themes, such as resource issues, understanding purpose of supervision, support system from family or colleagues and personal issues raised	The research process enabled practitioners to incorporate clinical supervision in their practice and also to examine the process systematically. Clinical supervision can be achieved if all staff can find the time for it.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Paul et al[31] 2004	How to meet patient and relatives' information needs on transfer from ICU?	Collaborative study used exploratory design	Semi structured interview	3	7 patients 2 relatives 4 previous patients 3 relatives 15 staff all disciplines	Development of information booklet. Which time patients / relatives felt the most useful time to receive information was 24 -48 h before transfer.	Collaborative work between patients, relatives and multidisciplinary team to improve information booklet which can help fulfil patient and relatives' needs upon transfer. Increased awareness on the need to provide written information to patients and families. Staff education related to patient and relatives' needs required during transfer from ICU.
Keen & James[30] 2004	How to develop a tool to aid nurses' decision making in dressing selection?	Action research	Questionnaires	2	37 nurses in ICU	Charts, including for wound assessment and dressing selection developed.	This tool can guide nurses in caring for patients with wounds.
Roulin & Spirig[38] 2006	How to improve staff knowledge and care for critically ill patients?	Action research	Discussion Focus group Interview	3	19 staff and 1 advanced practice nurse Physiotherapists – 2 Nursing assistants – 3 Nurses - 14	Patient history guidelines developed to know the patient as a person. Weekly nursing round introduced to improved care continuity. Patient dairies to help know what happened during their stay in ICU. Patient communication tools to increase nurses' technical knowledge to communicate with patients.	Development of new interventions allowed nurses to improve their knowledge and care for chronically ill patients.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Coyer et al.[34] 2007	What are intensive care nurses' perceptions of family focused nursing? Is family-focused nursing appropriate in intensive care environment?	Collaborative action research	Focus group discussion	1	6 nurses	Partnership in care of patients and families.	This study raised awareness of patient and family needs in ICU. It also built a platform for future action research interventions in this area.
Pinyokham[32] 2007	How to enhance nurses' capacity to wean patients from mechanical ventilator based on a developed programme?	Participatory action research	Focus group discussion Observation Workshop Group meeting	2	38 nurses 9 core working groups 4 administrators	Weaning programme developed for nurses to solve weaning problems.	Nurses learnt about weaning process.
Blanchard & Alavi[35] 2008	How do nurses negotiate the environment as they work with the family in ICU?	Action research	Reflective conversation	1	14 nurses	Underestimating family expectations and experience in ICU may result in misunderstanding.	Family assessment form developed to help nurses assess and meet patient and family needs in ICU.
O'Neal et al.[21] 2008	To what extent are practitioners in critical care exposed to evidenced-based practice, able to work in partnership with patients and develop a culture in clinical setting that values these qualities?	Action research	AGREE instruments Pilot appraisal tool	2	Not stated	Stakeholders highlighted the limited information in the guidelines.	Extent of exposures not stated; however, the term definitions misunderstood by staff, such as policies, procedures, protocols and guidelines. Protocol provides supportive structure for staff to follow to avoid any issues.

Study	Research question	Design	Methods	Phase	Participants	Results	Outcomes
Unahalekhaka[33] 2008	Can collaborative quality improvement reduce VAP in Thailand?	Collaborative quality improvement project	Audit of VAP surveillance system, Workshop Audit	3	253 health care workers from 18 hospitals in three regions in Thailand	VAP rate decreased from 14.2 to 4.2 per 1000 ventilator-days. VAP in all 18 hospitals declined after implementing collaborative quality improvement	Reduced VAP rates in participating ICUs. VAP surveillance system improved and data became more reliable. Advance in care for ventilated patients.
van der Wal & Globerman[40] 2008	How to enhance practice environment in critical care unit?	Participatory action research	Group discussion Workshop Retreat Education and support session	1	16 to 223 staff, other health care team and support staff	The staff felt valued and respected during the intervention	The intervention was successful and communication processes standardized and templates tailored to fit each unit's culture.
van der Wal et al.[41] 2008	What is the issue pertaining to practice environment in critical care unit?	Participatory action process	Survey pre- and post-intervention	2	Over 200 nurses and other health care teams	Pre- and post-intervention survey revealed significant improvement in four of five chosen priorities (adequate staff and resources, educational development and professional growth, collaborative relationships with team members and respectful relationship)	Team collaboration and communication improved

ICU-Intensive care Unit
VAP-Ventilator-associated Pneumonia

3.6.3 Focus of the reviewed projects study

Most of the studies involved collaborative activities with patients and their families,[31] patients and nurses,[36] nurses[21-24, 26, 27, 29, 30, 34, 35] and also other health care practitioners.[25, 28, 32, 33, 37-41] The number of participants in eligible studies ranged from 6 to 253. Many of these action research projects demonstrated the capacity to improve communication skills among the participants.[22, 33, 37, 38, 40, 41] This approach[22-25, 27-30, 32-35, 37, 38, 40, 41] improved clinical practice by development of protocols[21, 33, 37, 38] and integrating patient and family perspectives, and working in partnership with patients and families to address unmet needs.[31, 34, 38] Additional advantages of the action research method identified by this review are that the collaborative relationship between the researcher and participants in the clinical setting will enable change in their work culture[21, 26, 27] encourage team work[24, 33] and empower the staff,[21-23, 26, 37-41] as a consequence improving the patient outcomes.

Few of the projects reviewed aimed at improving clinical practice and knowledge, and increasing awareness of the participants in regards to oral care practice for the ventilated patients, partnership in care of patients and families, and nurses' awareness about patient and relative needs. A study on oral hygiene practice in the ICU by Kite[23] reported that five of seven nurses admitted that they never brushed their patients' teeth yet changed this behaviour following an action research project. Blanchard and Alavi[35] involved 14 participants in their study which discussed how to develop a way for nurses to understand, negotiate and work with families in ICU, and they were able to develop a plan to overcome the problem. This action research project created a better understanding for the patients, families and nurses related to the patients' and their family needs in the ICU. Coyer et al.[34] published the first phase of their four phase action research which included six nurses discussing their perceptions of family nursing in a focus group. This study also helped to increase nurses' awareness about patient and relative needs.

3.6.4 Limitations of action research

Action research was twice reported as a sucessful strategy to improve the functioning of a team during implementation of an innovation.[42] The involvement of a researcher in this process could be fraught with difficulty, especially in an outsider role when adopting a bottom-up, practice-based approach, and thus may need to have someone coordinate the innovation endeavour from within.[42] The role and responsibilities of the researcher may blur under such conditions and possibly lead to outcomes which are questionable. More research on team characteristics and team directed strategies is required.

Despite the benefits of the action research method there are also some caveats and considerations to be made in using it. Turnock and Kelleher,[39] in trying to maximise patient dignity using collaborative action research, identified in a focus group discussion that the influence of the medical paradigm undermined the value of the subject being investigated. An action research seeks to improve hand hygiene by education also found a similar result.[28] The educational programme had only limited value for health care workers except the doctors. The strengths and weaknesses of action research in the ICU based upon this review are summarized in Table 3.3.

Table 3.3 Strengths and weaknesses of action research in the ICU

Strength	Weakness
▪ Effective communication[22, 33, 37, 38, 40, 41]	▪ Difficult to control for extraneous factors[23, 26, 28, 39, 40]
▪ Change of work culture[21, 26, 27]	▪ Level of immersion of researchers precludes objectivity and balance[28, 31]
▪ Improved outcomes[33]	▪ Difficulty in recruitment[22, 26, 30, 34, 41]
▪ Encourage team work[27, 33]	▪ Family perspectives are difficult to include[35]
▪ Increased awareness on issues[22-25, 28-30, 32, 34, 40]	▪ Lack of feasibility to evaluate effectiveness of developing protocol/care plan/practice[23, 25-27, 29, 32, 38, 39]
▪ Empowerment of staff [21-23, 26, 38, 41]	
▪ Allows for a collaborative approach among health care workers[21, 22, 33, 37-40]	
▪ Allows incorporation of the perspectives of patients and family members in an iterative process[31, 34, 38]	
▪ Improved partnership in care among patients, their families and health care professionals[34, 38]	
▪ Development of protocols / guidelines to improve practices[21, 38, 39]	
▪ Improved clinical knowledge[21-23, 32, 33, 35, 37, 38]	

Although there is considerable application of quality initiatives[43] in the ICU, formal action research methods are less commonly applied than in community and other clinical practice settings.[5] There is a need to incorporate sequential steps of the action research process in the ICU. Promoting engagement, reflection and empowerment of participants contributes to achieving negotiated goals.

3.7 Discussion

An important finding of this review is that the majority of the studies focussed primarily on process and formative evaluation but not on sustaining the practice or measuring clinical outcome improvement. Although all studies used action research in their approach, this was predominately used in the planning stages and not always in an iterative and reflective process.[5] Most of the published action research articles were trying to solve problems in the clinical area and simultaneously improve the practitioners' practice.[23, 26, 27, 29, 31-34, 38, 39]

Sharp[44] indicated that action research is particularly powerful because it provides direct access to the area of investigation, learning from practice, recognising and valuing the diversity of perspectives and developing skills of reflective practice amongst practitioners.[8] This research approach is useful for investigating clinical problems and measuring the effectiveness of an intervention.[5] Waterman et al.[5] added that another potential effect is that action research has a lasting effect or influence on the participants. The focus of sustainability which is a compelling element of action research was largely absent in the studies identified.

Previous quality improvement studies have resulted in significant improvements in staff adherence to weaning protocols, quality care and also cost saving after implementation of the interventions.[45-47] However, achieving sustainability can be challenging and the following intervention-targeted outcomes regress without sustainable culture change. Although action research is firmly entrenched in developing and refining clinical practice, there are some distinct factors that differentiate this approach from other quality improvement approaches.

It could also be argued that the action research method presents a more thorough and potentially successful method to improve quality in health care. Firstly, action research is guided by prospective research questions that are addressed collaboratively with participants;[5, 8, 44] secondly, action research is context specific and focuses on education and empowerment;[5, 12, 44] and, thirdly, the implementation is participatory and engaging rather than prescriptive and authoritative.[5, 44] Studies in this review also found that engagement of a multidisciplinary team in the study process helped to improve translation to practice. An advantage of action research identified was the collaboration between those involved in the inquiry; therefore, the knowledge learnt from the process was directly relevant to the issues being studied.[44]

This review has showed that researchers have embedded a mixed methods approach within the action research philosophy, including workshop, reflective discussion, interview, surveillance and audit. Approaches used in the studies increased interaction, collaboration and teamwork among the participants, and thus helped enhance effective communication skills, work culture and empowerment of staff in the ICU. Waterman et al[5] indicated that the differences between action research and other types of research are the underlying philosophy of education, empowerment, support and emancipation of research participants. Action research is known to have the ability to generate new forms of understanding, practical knowledge and skills to create knowledge amongst individuals and groups[44] Therefore, the educative approach in action research will assist in increasing practitioner awareness, knowledge and practice around the problem.

A number of studies have identified the importance of involving a multidisciplinary health care team in the ICU[31, 33, 38-41] One study also included the patients and their families in the action research team.[31] Participation by various health care team members is an opportunity for the action research group to have a more comprehensive and contextualised understanding of the problems as well as better identification of the problems and development of appropriate, relevant and feasible innovations and strategies.[5] This perspective likely has an influence on sustainability.[48] An interdisciplinary approach is also viewed as helpful to overcoming barriers to change and in reducing the possible negative effects of

change. Common issues encountered in action research are the failure to reach consensus within the multidisciplinary team and in getting all the staff to effectively participate in the research. Engaging clinical leaders is important to addressing this approach.

Yet, as in any other research approach, obstacles can be encountered. Turnock and Kelleher[39] have identified some challenges in changing practice emanating from a biomedical paradigm which considered the study question to be unworthy of investigation. Waterman et al.[5] stated that conflict can arise from differing perspectives of a problem, arising from diverse professional backgrounds and conceptual underpinnings. Furthermore, getting all the staff to effectively participate is also problematic because unwilling participation in the action research team will also lead to resistance to any proposed change. Therefore, contemplating the use of the action research method requires the balancing of the strengths and weaknesses of this approach.

3.8 Limitations of the systematic review

A potential limitation of this review was the few papers found by the original search strategy. This may be that action research papers are not well indexed. Therefore, when hand searching was done - including the use of Google Scholar, Mednar and Scopus - twice more papers were found than from the original search. Steinbrook[49] indicated that the newer internet search engines, such as Google Scholar, can be useful for identifying articles that are not indexed well in the traditional bibliographic databases. Furthermore, searching the bibliographies of retrieved articles was helpful in identifying articles missed during the search.[50]

3.9 Conclusions

In conclusion, in spite of the widespread uptake of action research,[51] there are limited published studies showing the application of this method in ICU. Further in the articles identified for the review few reported patient outcomes. The majority of them focussed primarily on process and formative evaluation but not on sustaining the practice or improving clinical outcomes.

Involving all stages of the action research process in the ICU is imperative to improving patient outcomes. Empowering nurses to take control over their practice and monitor outcomes through nurse-sensitive patient outcome indicators is an important consideration.[22] Hillman[16] has described the ICU as a complicated and multifaceted organisational structure; thus, complex interventions involving evaluation of multilevel interventions and a interdisciplinary approach are required to optimise the effectiveness of the interventions. The use of action research can be a useful approach to address issues in patient management in the complex milieu of the ICU. In this study iterative and reflective process of action research were used during the stages and the main outcomes was to measure improvement of clinical outcomes and the sustainability of practice in the ICU setting.

This chapter has provided the background and justification for selecting the action research methodology for this study. Importantly, this review has underscored consideration of the following factors in driving clinical practice improvement in the ICU such as organisational support and considering elements of the professional practice environment. The following chapter will provide overview of the study setting, including participants' background, data collection tools and methods of analysis.

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CHAPTER 4

METHODS

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METHODS

4.1 Introduction

Chapter 3 has described the action research process and provided a justification for selecting this methodology for driving practice change. This chapter describes the study setting, participant characteristics, and assessment tools for assessing catheter related blood stream infection (CRBSI), ventilator-associated pneumonia (VAP) and pressure ulcer (PU). Study instruments are also presented as well as the method of analysis and a description of researcher roles. The dynamic structure of the action research process means that there is an interface between each of the data collection and reflective processes. For the ease of the reader these studies are presented in discrete studies aligned with the action research phases. Methodological considerations are provided in detail in this chapter and a brief description in subsequent chapters.

Following a request from the researcher, the department head, nurse manager and intensive care medical specialists in the Malaysia site agreed to participate in a nurse led project to improve complications in the intensive care unit (ICU). These individuals recognised the need to include the nurses in planning and collaboration for patient care. Several of these individuals had experience of working with nurses in countries such as Australia and the United States and recognised the opportunity for nurse- coordinated interventions and as a consequence an improvement in patient outcomes. The principal supervisor visited the study site and found them to be strongly supportive of the project and anxious to collaborate. In particular they saw this project as an important strategy for promoting engagement in evidence based practice (EBP) and also increasing the nursing role in driving practice change. The acronym for the INVEST Study is Improving Health Outcomes by Preventing Intensive Care Related Infection in Malaysia ICU.

4.2 Study setting and participants

Discussion concerning the characteristics of the General ICU in the Malaysian Ministry of Health hospital where this study was conducted was provided in Chapter 1. The study ICU is located at the East Coast of Peninsular Malaysia in a Ministry of Health hospital. This ICU is led by the Head of Department who is responsible for administrative management, and two intensive care medical specialists who provide consultation and clinical care. The nursing administration is headed by a Matron Associate to the Chief Matron in the hospital. Five ward managers manage the nursing service and medical assistants do the cleaning and maintenance of equipment. In 2009 to June 2010 there were 83 nurses, including five ward managers and three acute pain service nurses. In 2011, the number of nurses increases to 87 including five ward managers and three acute pain service nurses during data collection. The three acute pain service nurses were included in this study because they are part of ICU staffing and sometimes they also help to deliver care to patients when the unit is busy. The nurses in this unit are mainly a mix of diploma and certificate of nursing holders. In 2009, only three (3.6%) nurses had baccalaureate degrees and this increased to five (5.7%) in 2011. Forty two of these nurses had an intensive care nursing post-registration qualification.

Nursing in Malaysia generally evolves and remains similar to the British system that was introduced during the colonial period.[1] All basic and post-basic, inclusive of post-basic intensive care nursing, is still hospital-based. In mid 1990, the basic requirement for registration in nursing changed to a diploma,[2] including the intensive care nursing post-registration qualification. The entry requirement for nursing education is still low at *Ordinary level (O-level)* with slow progress and development in term of education and practice.[1] The nursing profession is not considered a high status profession.[1] Few Malaysian universities offer the post-registration degree programme to basic and diploma nurses to upgrade to a degree level.

The ICU had 16 beds in 2009, increasing to 17 in 2010. This ICU caters for the critical care needs of the entire State so has mixed medical and surgical units, and

is classified as Level 3 with facilities for multiple organ support.[3] This is an adult ICU however when bed needed surgical paediatric cases are also admitted. There are seven single rooms equipped with positive / negative pressure and 10 open beds.

In 2009 there were 70 to 90 admissions a month,[4] the total admission for the year was 824[5] increasing up to 111 a month in June 2010 to May 2011. (ICU Ward Manager, Personal communication, 29 June 2011). Admissions to ICUs in Malaysia have generally increased over the years due to the unit expansion and an increase in bed numbers. This increase was up 12% from 2008 to 2009.[5] In this ICU, the mean length of stay was 4.1 and 4.2 days in 2004 and 2008,[6] respectively. The planned nurse: patient ratio is 1:1 or higher in complex cases, but occasionally cannot be maintained due to staff shortages.

Although, the importance of the multidisciplinary team is recognised, the INVEST Study focussed on the nursing role and therefore nurses and ward managers were primarily involved in the projects with the support of the medical team. Although they were part of the culture change student nurses and those nurses who were not part of the permanent staff establishment were excluded from data collection.

4.3 Assessments tools

A range of objective assessment tools were used as part of the formative and summative assessment of the action research project and to be consistent with the planning, reflection and analysis phases of the action research project.

4.3.1 Assessment tools for ICU complications

This study used checklists to assess the three complications in the ICU. The Center for Disease Control and Prevention (CDC) diagnostic criteria for VAP[7] and CRBSI[8] were used by all Ministry of Health hospitals. As the ICU did not have any tool to assess PU, the *Waterlow Pressure Ulcer Risk Assessment*[9] was used based on its reliability and validity in the critical care setting.[10] Weststrate and colleagues found that the Waterlow *Pressure Ulcer Risk Assessment* scale score over the last 24 hours is the best predictor for development of PU in the next 24 hours in ICU patients.[10] The scale also contains a number of intrinsic factors commonly assessed in a variety of clinical settings.[11] The checklists are provided in Chapter 2 where baseline data are reported and summarized in Table 4.1.

Table 4.1 INVEST study: Checklists used as assessment tools

CHECKLIST
1. Waterlow Pressure Ulcer Risk Assessment Scale[9]
The scale differentiates between 'at **risk',** 'high **risk'** and 'very high **risk',** and appears more suitable than other tools for a wider age group[12]
2. Pressure Ulcer Staging System[13]
This scale divides pressure ulcer development into six stages
3. Center of Disease Control and Prevention diagnostic criteria[7, 8]
CDC diagnostic criteria for VAP and CRBSI were used for this study after consultation with intensivists and a microbiologist in Malaysia. Both criteria are used as guides in all Ministry of Health hospitals.

CDC- Center of Disease Control and Prevention
CRBSI-Catheter Related Blood Stream Infection
VAP-Ventilator-Associated Pneumonia

4.4 Data collection methods and instruments used

This study used mixed methods of data collection. These methods include interviews with the stakeholders, a nurse survey, patient profiling and focus group discussions.

4.4.1 Environmental scan and interview with the stakeholders

An environmental scan[4] on the entire organisation especially the ICU including internal and external factors was conducted by the researcher and her supervisor and was documented as field notes. Interviews with the head of department, intensivist, and ICU nurse managers were conducted to assess for organisational readiness and factors to drive clinical practice improvement. The interviews were documented in the INVEST project issues log - barrier, facilitator, action and resolution (Appendix 1).

4.4.2 Patient profiling

Patients with complication data were collected using a patient data collection form which was developed by the researcher and supervisors consisted of two sections: *general demographic patient information* and *disease-specific information* (Appendix 2). The form was to document patients confirmed with VAP, CRBSI or PU. It was completed by the researcher for every patient identified with target conditions, and the patient then followed until discharge from the hospital.

Section 1: Demographic Information

Section 1 collected information of the age, sex, diagnosis on admission, date of admission / transfer / discharge (or death), status on discharge, diagnosis on transfer or cause of death and length of ICU stay of eligible patients. It had blanks to be filled in with the details.

Section 2: Disease Specific Information

Section 2 collected biomedical information, including co-morbidity, type of complications and organisms isolated, biochemistry, Glasgow Coma Score, Simplified Acute Physiology (SAPS II), Sequential Organ Failure Assessment (SOFA), Charlson Comorbidity Index score, name of department inserting central line / intubation, location of central line insertion, route of intubation, status on discharge from hospital, ward/hospital length of stay, and finally discharge summary from ICU/ward/hospital.

Disease severity scoring

Disease severity scoring, such as the Simplified Acute Physiology (SAP II) score for severity of disease, and SOFA, an organ dysfunction score, were developed for critically ill patients[14] as organ dysfunction and failure are the major problems affecting patient outcome in the ICU.[15] From the severity of illness measured, SAP II predicts the patient outcome,[16] the probability of mortality based on the patient variables in the first 24 hours of hospital stay.[16] It proved to be a good scoring system for severity of illness.[17] The measurement gave integer scores between 0 and 163 or predicted mortality between 0% and 100%. SOFA calculates a summary value of repeatedly assessed routine variables defining the severity of dysfunction for six organ systems - respiratory, coagulation, liver, cardiovascular, central nervous system and renal - in critically ill patients over time.[18] There are four levels of dysfunction identified for each system. The score is based on six sub-scores, one for

each system, and ranges between 0 and 24. Organ dysfunction is associated with high rates of ICU morbidity and mortality.[19] The SOFA score includes fewer parameters than most other scores, offering a simpler way to evaluate morbidity. [14, 19]

Comorbidity

The Charlson Comorbidity Index predicts the one-year mortality for a patient with a range of co-morbid conditions, such as heart disease, AIDS or cancer (a total of 22 conditions). Each condition is assigned a score of 1, 2, 3 or 6 depending on the risk of dying associated with the condition. The Charlson index is frequently used in critical care research and consistently associated with patient mortality.[20] The index is frequently used in critical care research to assess patient mortality.[20] It enables planning for future health care interventions.

Section 2 also had fill-in-the-blank items, such as disease severity scores (SAPII, SOFA), length of stay in ward/hospital, or *select from multiple answers*, such as type of microorganisms and Charlson Comorbidity Index. The disease severity scoring determined the differences in patient severity of illness in the pre- and post-intervention groups.

4.4.3 Nurse survey

A survey was undertaken to assess the nurses' knowledge of VAP, CRBSI and PU prevention, professional practice environment and sustainability of the change process (Appendix 3). This survey had four sections: *Socio-demographic Information, Professional Practice Environment,[21] Sustainability Index[22] and Knowledge Question of prevention of VAP, CRBSI and PU.*

Section 1: Socio demographic Data

The socio-demographic information collected included age, qualification, role in the unit, length of service as nurse and length of service in the ICU.

Section 2: Revised Professional Practice Environment (RPPE)

Section 2 was the Revised Professional Practice Environment (RPPE)[21] scale. The RPPE was developed by Erickson and colleagues[21] to identify acute care facilities in the United States that attract and retain nursing professionals. No changes were required because this study also conducted in the acute care setting. The RPPE tool provides a comprehensive picture of the current acute care professional practice environment and identifies issues in inter-professional practice and conflict resolution.[21] It can provide effective information to help the nursing leader improve the department in various areas.[21] The validated scale had 39 items involving *handling conflict* (9 items, 2 negatively worded), *internal work motivation* (8 items), *control over practice* (5 items), *leadership and autonomy in clinical practice* (5 items), *staff relationships with physicians* (2 items), *teamwork* (4 items, three negatively worded), *cultural sensitivity* (3 items) and *communication about patients* (3 items). The scale was rated on a Likert scale based on the nurses' agreement with each statement (1 = strongly disagree; 4 = strongly agree). The score from each item was derived directly from the Likert scale except for negatively worded item (5 items). Total cumulative mean scores from each component was divided by number of items in the component for the total mean score in each component.

Section 3: Sustainability Index

The Sustainability Index developed and validated by the United Kingdom Institute for Innovation and Improvement was used to predict the likelihood of sustainability of change and identify aspects that help increase the chances of

sustained improvement in service delivery.[22] In action research, this model has been tested by the National Health Service in the United Kingdom and found to perform well and be helpful in identifying areas that adversely affect the likelihood of improvement sustainability.[22] The advantages of the model in planning and measuring sustainability include: *identifying and correcting barriers, monitoring progress of the change effect, selecting changes to address, allocating implementation resources, and identifying the pros and cons of implementation patterns in an organisation*.[22] The Sustainability Index consists of 10 items grouped in three categories – *process* (4 items), *staff* (4 items) and *organisation* (2 items)- with maximum scores of 31.5, 52.0 and 16.9, respectively.[23] The total maximum score for the three categories is 100, with a higher score indicating a higher chance of sustainability. A score of ≥55 is reason for optimism, while ≤45 suggests some action to be taken to increase the likelihood of sustainability.[23]

Section 4: Nursing Knowledge Assessment

The knowledge component of the survey was assessed using a 14-item investigator-developed questionnaire following review of available EBP guidelines for prevention of these three complications in the ICU.[7, 24-37] In this section, the nurses were asked to rank on a Likert Scale of 1 to 10 (1 = strongly disagree; 10 = strongly agree) the importance of EBP in nursing practice. Ten point Likert scale was chosen for this section to precisely evaluate the nurses' level of knowledge in prevention of ICU complications.

The questionnaire underwent a face validity test by five leading Malaysian nurses with critical care backgrounds. They were two nursing directors from the Malaysian Ministry of Health, one nursing lecturer from a public university, one nurse educator from a private hospital and one nurse manager from a Malaysian Ministry of Health hospital. Three reviewers suggested translating selected words to help the nurses understand some of the questions. Approximately 18 words were translated into Bahasa Malaysia and attached to the questionnaire. All the reviewers agreed with the relevancy and appropriateness of the questionnaire. After the

validity test, the questionnaire was trialled on five nurses to determine the clarity of the questions – a nurse manager from the neonatal ICU and four nurses from the coronary care unit. All agreed on the clarity of the questions posed. The survey used the validated questionnaires in Table 4.2.

Table 4.2 Content of knowledge items

	Knowledge	References
1	Hand washing practice for infection prevention,	[38-42]
2	Use of alcoholic antiseptic solution for hand washing	[39, 41]
3	Requirement for head of bed elevation >30 degrees,	[27, 30, 43-46]
4	Early enteral nutrition initiation	[25, 42]
5	Early mobilization	[47, 48]
6	Benefit of subglottic suctioning	[37, 46, 49, 50]
7	Maximal barrier precautions	[38]
8	Use of chlorhexidine for prevention of VAP and CRBSI	[27, 49, 51-53]
9	Regular positioning in preventing VAP and PU	[25, 42]
10	Indication for PU assessment	[38, 40, 42]
11	Patient showing specific signs and symptoms of developing VAP and CRBSI, requirements for sending blood or tracheal secretions for investigation if patient	[7, 8, 28, 54, 55]
12	Requirements for sending blood or tracheal secretions for investigation if patient shows signs and symptoms of infection,	[8, 55]
13	Hygiene care to help reduce infection in ICU patients	[56, 57]
14	Exposure to evidence-based practice helping nurses prevent ICU complications.	[43, 58]

CDC- Center of Disease Control and Prevention
CRBSI-Catheter Related Blood Stream Infection
ICU-Intensive Care Unit
PU-Pressure Ulcer
VAP-Ventilator-Associated Pneumonia

The test battery for the nurses' survey had several purposes. Firstly, it provided baseline data to inform the intervention and assess information and knowledge needs and secondly provided an objective method for assessing the impact of the action research method in a pre-test, post-test design to be summarised in Chapter 5, 7 and 9.

4.4.4 Focus group discussion

Focus groups were undertaken with nursing staff to discuss the barriers and facilitators to change in preventing VAP, CRBSI and PU. The discussions were conducted during the intervention and post-intervention phase. The purpose of focus groups in the intervention phase were to ascertain nurses' experiences and perspectives[59] of incorporating the VAP, CRBSI and PUs assessment tools into daily practice. In the post intervention phase focus groups were conducted to ascertain participants' experiences and perspectives of change adopted in the ICU.

The focus group was chosen to capture the participants' view on their experience of the practice changes introduced. This method of data collection is useful as it obtains a range of views, some not even anticipated by the researcher.[60] Group discussion is useful to explore the collective view and culture in the work environment.[61]

Groups were held in the ICU family meeting room and audio recorded with consent of participants. Available nurses were invited to participate in groups conducted in Bahasa Malaysia (98%) and English by the researcher. Field notes were compiled following each focus group to document and reflect on the process of and information gathered from each focus group. The consolidated criteria for reporting qualitative studies was used to guide the study design and data analysis of the focus groups.[61]

4.5 Data collection

The data collection included environmental scan, reflective field notes, patient data, a survey and focus groups. The data collected are shown in Table 4.3.

Table 4.3 Data collected

INVEST STUDY DATA COLLECTION ACTIVITIES
Phase 1 Pre-Intervention (December 2009 to January 2010)
PATIENT DATA
○ Rates of VAP, CRBSI and PU.
PROVIDER / NURSES
○ Environmental scan ○ Survey: Nursing Practices in ICU questionnaire, RPPE, NHS Sustainability Tool
Phase 2 Intervention (February to July 2010)
NURSES
○ Focus group discussion, fields notes
Phase 3 Post Intervention (March to May 2011)
PATIENT DATA
○ Rates of VAP, CRBSI and PU ○ Patients' Admission number, characteristics, length of stay
NURSES
○ Survey: Nursing Practices in ICU questionnaire, RPPE, NHS Sustainability Tool ○ Focus group discussions, fields notes

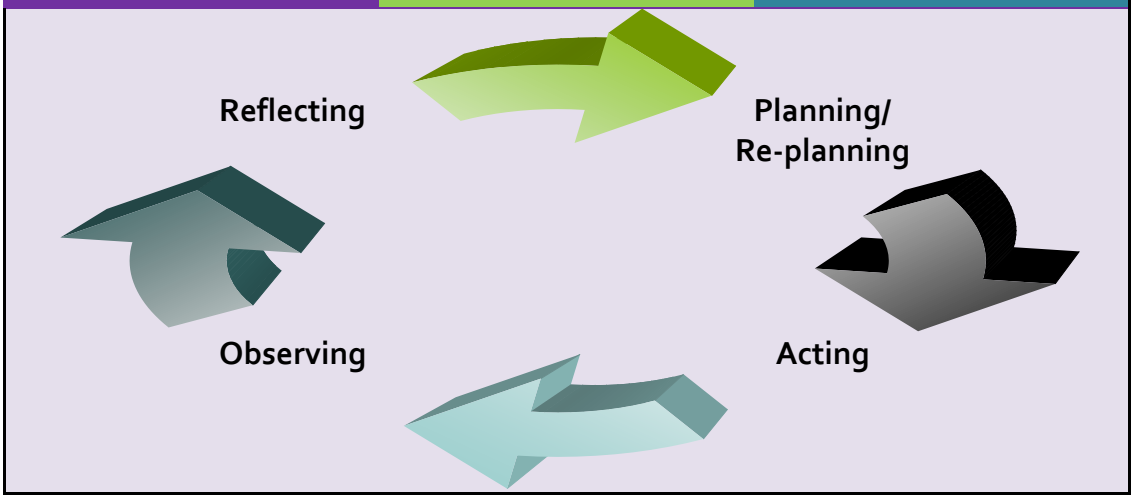
CRBSI- Catheter Related Blood Stream Infection
ICU- Intensive care Unit
NHS- National Health Services
PU- Pressure Ulcer
RPPE- Revised Professional Practice Environment
VAP- Ventilator-Associated Pneumonia

4.6 Data collection process

This section explains the data collection and the action research cycles by which innovations were managed and evaluated. In this study, the data were collected in three phases (Table 4.4) which were designed to follow the action research cycles of planning, acting, observation, reflecting and re-planning.

Table 4.4 Data collection phases

Pretest and Consultation Months 1-2 (2 months)	Intervention Months 3-8 (6 months)	Post-test Months 16-18 (3 months)
Rates of VAP, CRBSI & PU. Knowledge, attitudes & beliefs of study participants. Identification of barriers & facilitators to evidence-based practice.	Action research cycles with interventions based on increasing adherence to evidence-based guidelines & promoting control over clinical practice.	Rates of VAP, CRBSI & PU. Knowledge, attitudes & beliefs of study participants. Identification of barriers & facilitators to evidence-based practice. Sustainability & impact of intervention.



CRBSI- Catheter Related Blood Stream Infection
PU- Pressure Ulcer
VAP- Ventilator-Associated Pneumonia

Data collection was ongoing throughout the study, during which a number of action research cycles emerged as spirals of activity.[62] Each cycle comprised a period of planning, acting, observation, reflecting and re-planning.[62] Action research is able to deal with a number of problems at the same time and often spirals of activity lead to other spin-off spirals for further work.[62]

The focus of this action research was to implement change in this ICU. Data collection was run concurrently with planning of work. Reflective field notes based on participant observations and conversation with the ICU management, such as the head of department, intensivists and ward managers, were used to monitor the process of change and reflect on the learning gained and fed back to the participants to guide subsequent action. Details of the individual action cycles are described below.

4.6.1 First action research cycle: Introducing evidence-based practice

The first phase was to gain the support of the medical and nursing management. A meeting and interview were held with the head, intensivists and nurse managers to inform them the purpose of the study and to assess the ICU for its readiness for change. After the meeting, the nurses were introduced to EBP during a continous nursing education (CNE) session. Session focused on orientating staff to the CDC criteria for diagnosis of VAP and CRBSI, and the Waterlow Pressure Ulcer Risk Assessment Scale. They also were taught how to classify PU using National Pressure Ulcer Advisory Panel (NPUAP) pressure ulcer staging. The Waterlow pressure ulcer risk assessment scale was the first documentation used to record the process of PU assessment in the unit. The CDC diagnostic criteria and Waterlow Pressure Ulcer Risk Assessment Scale were used as the bases to collect the baseline data on VAP, CRBSI and PUs. During the session nurses including the senior nurses were asked to engage in the identification of problems in the setting. However, in the present hierarchical health care organisation the nurses in this setting preferred the direction of change to come from top management either from head of

department, intensivist or nurse manager. They will carry out the change if the direction was initiated and supported continuously by the top management.

During this cycle, nurses were encouraged to question, and their concerns immmediately addressed by the researcher individually or posed to the group. A patient information form was developed and used for pre- and post-intervention data collection. The pre- data consisted of an environmental scan including interviews with the key stakeholders, patient profiling and nurse survey. The data were collected over two months, and the results are presented in Chapter 5.

4.6.2 Second action research cycle: Implementing evidence-based interventions

The interventions were conducted over six months. The pre-intervention process included activities to remind the nurses about the project and infection control practices, such as hand washing, and assessment of ICU complications. The action research interventions conducted were as below.

Bags with the INVEST Study logo were distributed to all nurses and consisted of two pens, diagnostic criteria for VAP, CRBSI, Waterlow PU assessment scale, PU staging and central catheter line insertion team checklist. The checklist consisted of central venous catheter (CVC) placement (e.g. in subclavian vein, internal jugular or femoral vein), date of procedure, time started and completed, and elements of the bloodstream infection prevention bundle. Nurses were encouraged to use the central line insertion checklist as a guide before and throughout the central line insertion procedure. They were advised to tell the doctor politely if any breach in aseptic techniques happened. The bags were given at the early stage to motivate and create the environment for change.

The researcher met the participants every day over two weeks and re-enforced the principles of the project through bedside teaching. After that, the teaching continued on alternate days for another two weeks during office hours. The researcher also visited unit at night to help staff with the assessment of PU. After

that, she visited three times a week to offer individual coaching for the nurses learning the change.

Infection control posters from the WHO,[63] such as *5 moments for hand hygiene, How to hand rub?, How to hand wash?, 6 key elements for safe insertion of central lines*[64], and *Hand washing reminder* from the *Wash Hands Saves Lives* programme[64] were placed in the ICU as reminders and to create awareness about the change process. The VAP criteria[65] for patient and CRBSI insertion checklist were placed at the bedside. All the posters were prepared by the researcher and health promotion officer at the hospital.

A 30 degree head of bed measuring stick was made based on protractor version as described by Clinical Excellence Commission.[66] The first measuring stick was made from a thick plastic channel (pipe) for electric wiring. The measurements were given to a worker to duplicate 20 more sticks to hang at each bed side (with some spares) to remind the nurses to elevate the head of bed after each time they position the patient.

Current evidence-based articles were placed in a file in the unit to increase the nurses' knowledge and awareness of EBP. Every week, the researcher added a new article in the file and told the nurse manager and nurses so. They were encouraged to read the articles to learn more about EBP and ask questions if they have any difficulty in understanding them.

During the intervention period, the researcher consulted the dietician regarding monitoring the patients' nutritional status. It is common ICU practice to have a dietitian monitor every patient and plan their feeding to ensure adequate calorie intake. The nurses adhered to the dietitian prescriptions for patients. Nutrition was delivered via either nasogastric or gastrostomy tubes. In this study adequacy of patient nutrition intake is not discussed because this practice was already integrated into the standard care in the unit. However, the importance of this activity in preventing, VAP, CRBSI and PU was emphasised to nurses.

During the intervention, it was found that chlorhexidine was not used in the ICU due to contamination (ICU Ward Manager, Personal communication, 5 March 2010). The pharmacist explained that the contamination occurred from reuse of a dilute solution from the pharmacy after 24 hours. After negotiation with the pharmacist, she agreed to supply pure chlorhexidine in small amounts (10-20 milliliter) to avoid contamination. The instructions for dilution of chlorhexidine were given by the pharmacist and the nurses were told to discard any chlorhexidine once opened together with the same bottle used. All nurses were encouraged to use chlorhexidine for disinfect during insertion of the central venous line, any aseptic procedures and also in oral care collectively with tooth brushing of ventilated patients. Chlorhexideine 0.2% was used for oral care directly prepared by the pharmacist. Dilution for other aseptic procedure was 20 milliliter of 5% chlorhexidine plus 30 milliliter of distilled water. (ICU Ward Manager, Personal communication, 4 October 2011)

During the intervention period, nurses were still using a stainless steel wash basin for bathing the patients, and the basin reused for the next patient without any sterilization. The need to change the wash basin was based on the CDC guidelines for environmental infection control which make a strong recommendation for elimination of environmental reservoirs of microorganisms (eg, the bath basin and nebulizer).[56] After discussion with three ward managers the practice was discontinued. The ward manager agreed to replace the stainless steel basins with disposable ones which only cost RM1 (USD 0.317).

Monthly sessions on nursing education (CNE) were conducted by the ward managers and attended by ~30 to 40 nurses. During the sessions, the researcher gave feedback to the participants on nursing care practices observed by her, and also discussed any issues / problems encountered in implementing EBP. They were asked to reflect on their practice and suggest ways to improve it. For example, during admission / transfer out, nurses used the same gloves throughout the process procedure, including changing the bed sheets to manipulation of the central or intravenous line, or giving drug infusions. In the sessions, the frequent use of hand wash or rub was emphasized and demonstrated each time before and after they

attended their patients. There were 12 hand wash sinks in the study setting. Two single rooms share one sink placed near the staff entrance. Antiseptic hand rub was generally available on a small table (on which is also placed the cardiac monitor) at the end of each ICU bed; however, it was not always there, especially if the patient was in traction. Gloves, masks, and aprons are located at the patient bedside. They were also encouraged to tell any medical officers not practicing hand washing before attending a patient to do so as suggested by the World Health Organisation (WHO).

Small tag diagnostic criteria for VAP and CRBSI were also provided based on feedback from the focus groups, the nurses found the A4-size VAP and CRBSI assessment criteria too bulky to carry around to each patient. They (criteria) were therefore printed on a small tag which was wearable as a ‘name tag’. During the study, field notes were kept by the researcher for self reflection. The list of intervention activities are presented in Table 4.5.

Table 4.5 INVEST study: Intervention activities

INVEST STUDY INTERVENTION ACTIVITIES
Phase 2 Intervention (February- July 2010)
○ Infection control prevention posters and reminder: - Hand washing - Check patient for VAP - Safe insertion of CVP line - Diagnostic criteria for VAP - Central catheter line insertion team checklist ○ INVEST Newletter ○ Evidence-based articles ○ Feedback on hand washing compliance ○ Consultation with dietician: Daily monitoring of patient nutritional status ○ 30° head of bed elevation measuring sticks ○ Tooth brushing for ventilated patients ○ Continuous nursing education and bedside teaching - Change to disposable sponging basin - Use chlorhexidine in ICU ○ Small tag diagnostic criteria for VAP and CRBSI

CRBSI- Catheter Related Blood Stream Infection
CVP- Central Venous Pressure
ICU- Intensive care Unit
PU- Pressure Ulcer
VAP- Ventilator-Associated Pneumonia

4.6.3 Third action research cycle: Reflection of change process

The focus groups were used to reflect on the change implemented. Discussions involved challenges during the intervention period, including the advantages / disadvantages of applying evidence-based guidelines in their daily practice. During these sessions, the baseline data collected and analysed were shared with the nurses The discussions were used to gather descriptive data by audio recording in the participants' own words, so that the researcher could develop insights on their perceptions of issues and challenges.[67] The findings from the focus groups are presented in Chapter 6. A small tag on diagnoses of VAP and CRBSI was distributed to all nurses to facilitate the assessment of these two complications based on the feedback from the focus groups.

Based on the conversations with the participants, the researcher identified a need for obtaining feedback concerning hand washing practices. Although data were available this was distributed only at the heads of department level. Hand washing compliance data for all ICU health care workers collected in December 2009 to April 2010 were presented to the nurses and intensivist after verbal permission to do so by the ward managers. There were 12 observations made a month from December to February, and then 28 a month, giving a total 92 observations.

4.6.4 Evaluation phase

This phase was undertaken formally from March to May 2011, although evaluation and reflection were actually ongoing throughout the study. There was a review of patient records and relevant ICU documents, after seven-month follow-up to compare the effectiveness of change of practice from the baseline period. After the patient profiling, a nurse survey was conducted followed by focus group discussions.

During the discussions, the findings from each action research cycle were shared with the participants to reflect on what had been achieved / not achieved and to obtain their opinion. In the evaluation phase, it was possible to enhance the findings and further set the study in its context.[62] Most importantly, all findings were shared with the participants to allow them to critically comment on them and to obtain their agreement for the results to be shared with a wider audience.[62] A flowchart of the overall data collection process is presented in Figure 4.1.

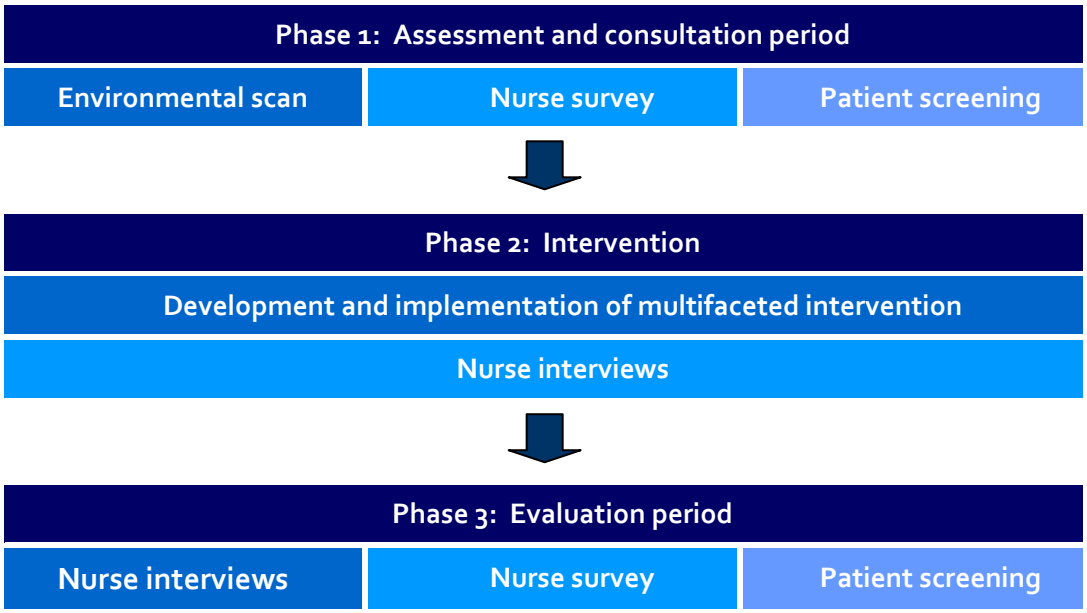


Figure 4.1 Flowchart of overall data collection process

4.7 Researcher's role in the study

The researcher had worked in this hospital as a nurse in the critical care areas before leaving to take on a teaching position at a university almost 10 years ago. In doing this project, there was a sense of going back as an *insider*. This was helpful in enabling the change process by having a better understanding of the setting and being able to foster more meaningful relationships with the participants. Although less than 10% of the staff had worked with the researcher previously, the head was the

same and supported the study. Support was also given by the intensivists who felt that the current nursing practice needed to be updated.

In the study, the researcher invested much time in getting to know the participants as individuals by listening to their concerns and helping those desirous to change their practice. The researcher believed that by knowing them as individuals would they became closer and confides their stories.

Wherever possible, the researcher endeavoured to be an *insider* and to be a trusted and valued member of the team. She joined the nurses during their continuous nursing education and gave them feedback on their current practices observed. She also joined them during tea breaks to chat and build up rapport in order to better understand their problems. In action research, outsider researchers must gain their practitioners' trust and agree to rules on the control of data and their use and on how potential conflict will be resolved within the project.[68] This is an important aspect for the success of change implementation. Rapport was developed when the researcher became the support, mentor and motivator for the nurses during the study.

With her previous experience of working in the unit and being a fellow citizen in the country, the researcher was aware on how issues of power, culture and status impact on the lives of the bedside nurses. The voluntarily participation was reinforced to the ward manager who invited the participants for the focus groups during their shifts.

4.8 Data analysis

Due to the complexity of the research milieu and the inherent processes of action research, both quantitative and qualitative data were used to evaluate both formative and summative aspects of the project. Both quantitative and qualitative data were considered of equal importance in the analysis. However, of importance the qualitative data elucidated aspects of the research process that were

unanticipated. The use of multiple approaches enhances construct validity and aids in interpretation of a particular phenomenon.[69, 70] As part of this project an embedded mixed method analysis was implemented in the action research method.

4.8.1 Quantitative data

Data for patient profiling and nurse survey

Quantitative Data were analysed using the Statistical Package for Social Sciences (SPSS) 19.0.1 Standard Version. Missing data were treated as system-missing values and the reverse scale items were computed into new variables before sum-up. The response rates and sample characteristics were analysed using descriptive statistics with the proportions (percentages) and/or measures of central tendencies. All the data entered were double-checked for accuracy. The numbers of patients who developed ICU complications were analysed by the Chi-square test to determine significant differences between pre- and post-intervention cycles. The nurses' level of knowledge on prevention of VAP, CRBSI and PU were analysed using the independent t-test for any association in the knowledge levels between the pre- and post-intervention groups. An alpha level of 0.05 ($\alpha = 0.05$) was used in the data analysis. Results were reported as statically significant when p-value is 0.05 or less.

4.8.2 Qualitative data

Data for environmental scan and interview with stakeholders

Data from the interviews with stakeholders and field notes were used to evaluate the barriers and facilitators to change in the practice of preventing VAP, CRBSI and PU in the ICU. Interviews of key stakeholders were analysed using thematic analysis.[71] Data sources were then interpreted as a whole to resolve ambiguities and to elicit confirmation of observations and identify divergence and convergence of views, opinions and observations.[72] Emergent themes were

discussed with the supervisors and assumptions verified from both qualitative and quantitative data sources.

Data for focus group discussion

Recorded focus group proceedings were transcribed in Bahasa Malaysia to preserve the nuances of conversation.[73] At least one participant from each focus group reviewed their respective transcript to ensure accuracy of proceedings. Preliminary content analysis was conducted by the researcher which included multiple readings of transcripts. The researcher is bilingual with more than 10 years critical care nursing and nursing research experience in Malaysia. All interviews were reviewed and categorised using colour coding. The colour coded categories were then extracted and group together in a separated file and then were translated to English. The extracted and translated interview were reviewed, clustered and tabulated to find further meaning and further analysis was conducted by the researcher. Analysis of the qualitative data will include searching for similar themes and recurring patterns.[67]

Researcher supervisors who were not involved in the data collection process reviewed the analysis to confirm congruence of themes. Continuous iterative data analysis was used and discrepancies were reconsidered and thematic patterns reviewed, renamed, collapsed, and clustered. This process was continued until the researcher and her supervisors were convinced that the themes illustrated the participants' perspectives.

4.9 Ethical considerations

This study was approved by the Malaysian Ministry of Health Research Ethics Committee and Curtin Human Research Ethics Committee and (Appendix 4) informed verbal consent obtained from key stakeholders before their interviews. Nurses were given participant information sheets prior to completing their survey

(Appendix 5). The return of completed surveys was considered as consent to participate. Verbal consent was also obtained from the nurses prior to their interviews. All the nurses were assured anonymity in their participation. Patient consent was not sought because VAP, CRBSI and PU assessments and preventions were part of the usual care provided in the ICU.

All hard data collected were filed and stored in a locked cabinet in the Department of Medicine, Faculty of Medicine and Health Sciences University Putra Malaysia. All data interview data were stored electronically on computer for seven years after which they will be destroyed. Data will be destroyed by means of shredding at the end of the seven year period. Only authorised study personnel will have access to study database, which is password protected. Data collected in this study was only be used for the purpose of the study.

The researcher was also mindful of the potential impact of the study on staff dynamics and provided support to minimise conflict. This was largely achieved by engaging nurses in the process and providing clear and transparent instructions regarding the aims and outcomes of the intervention.

4.10 Summary

This chapter has provided an overview of the study setting, including participants' background, data collection tools, action research cycle used in the study, methods of analysis and ethical considerations. The following chapter will provide the Phase 1 results, including a more in-depth description of the process of data collection with the environmental scan, nurse survey and patient screening. The next chapter will give an in-depth understanding of the barriers and facilitators in providing care for patients in the ICU.

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CHAPTER 5

PHASE 1: ASSESSMENT OF ORGANISATIONAL READINESS

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5.1 Introduction

Chapter 4 has provided a description of the methodology applied in the INVEST Study. In order to understand the barriers and facilitators to implementing evidence-based practice (EBP) in the intensive care unit (ICU), pre-intervention data were collected. This chapter describes the Phase 1 data collection which included an environmental scan, patient profiling and a nurse survey. This first phase provided the background to which subsequent intervention phases were designed and represented the initial cycle of the action research approach. The study methods, setting, participant characteristics, and instruments will be explained briefly and more detail regarding the study methodology is provided in Chapter 4.

5.2 Aim

This chapter describes the organisational readiness and factors to drive clinical practice improvement focusing on preventing three major Malaysian ICU complications: ventilator-associated pneumonia (VAP), catheter related blood stream infection (CRBSI), and pressure ulcer (PU).

5.3 Method

A mixed methods approach was used in the Phase 1 data collection, including an environmental scan, interviews with stakeholders, patient profiling and a nurse survey. Further details are provided in Chapter 4.

5.3.1 Study setting and participants

The study was conducted in December 2009 to January 2010 in a 16-bed ICU in a Ministry of Health teaching hospital in Peninsular Malaysia. There were 83 nurses, including five ward managers and three acute pain service nurses. Further details of study setting and participant characteristics are provided in Chapter 4.

5.4 Qualitative data collection

5.4.1 Environmental scan and interviews with key stakeholders

An environmental scan focuses on the entire organisation including internal and external factors.[1, 2] Chapter 1 has provided some background contextual factors and a summary of factors impacting on the Malaysian ICU. Although there is an increasing trend in monitoring clinical outcomes, definitive roles for nurses in this process are not well defined and to date there are limited nurse-led interventions which are published and peer reviewed.

A review of internal and external policies and administrative documents, assessing the ICU setting, number of staff and nurse: patient ratios was undertaken.[2] Interviews were held with the head of department, intensivist, microbiologists, ward managers and nurses regarding the diagnostic criteria used in the unit for VAP and CRBSI, and key barriers and facilitators to change in nursing practice. Field notes were taken during the environmental scan and interviews held with key stakeholders, systematically documented in an issues log (barrier, facilitator, action and resolution).

5.5 Quantitative data collection

5.5.1 Patient profiling

All the patients admitted to the ICU in December 2009 were screened using the CDC diagnostic criteria for VAP [3] and CRBSI.[4] They were assessed for PU in the night shift from midnight until discharge from the ICU.[5] Detected cases of VAP, CRBSI and PU were followed up by the researcher until the patients were discharged from hospital. Patient information for those with VAP, CRBSI and PU provided a baseline for the quality improvement initiatives. Further details on the patient with complication form are provided in Chapter 4.

The Malaysian Registry of Intensive Care has reported surveillance data for the National Audit on Adult Intensive Care Unit (NAICU) from 2003 to 2008 with mean SOFA scores from this ICU in 2007 to 2008 of 5.7 and 6.3, respectively. The mean SAP II scores from 2003 and 2008 were 42.1 and 37.6, respectively, which indicates little change over the period. The average mean SAP II score in the Ministry of Health hospitals was 35.2 which has a predicted risk of in-hospital mortality of 27%.[6] This ICU reported mean lengths of stay of 4.1 and 4.2 days in 2004 and 2008, respectively. The mean lengths of ICU stay in Ministry of health hospitals was 4.7 days, stable over six years.[6] The mean length of stay in this hospital (16.6 and 16.7 days in 2004 and 2008, respectively) was also unchanged (Table 5.1).

Table 5.1 ICU patient characteristics reported by National ICU Audit from 2003 to 2008

Patient information	Year					
	2003	2004	2005	2006	2007	2008
SAP II (Mean)	42.1	37.1	42.7	*	39.8	37.6
SOFA (Mean)	*	*	*	*	5.7	6.3
ICU length of stay (Mean days)	*	4.1	3.9	3.5	4.3	4.2
Hospital length of stay (Mean days)	*	16.6	14.4	16.1	15.2	16.7
Incidence of pressure ulcer	*	*	*	*	0	0
VAP (VAP/1000 ventilator days)	26.2	29.7	6.8	*	6.2	8.2
Crude in-ICU mortality rate (%)	*	25.1	32.7	27.0	23.7	16.5
Crude in-hospital mortality rate (%)	*	31.4	42.0	38.1	33.0	24.8

* Data not available

ICU -Intensive Care Unit
SAP II- Simplified Acute Physiology
SOFA- Sequential Organ Failure Assessment
VAP-ventilator-Associated Pneumonia

5.5.2 Nurse survey

The nurse survey had four sections: *SOCIO-DEMOGRAPHIC INFORMATION, PROFESSIONAL PRACTICE ENVIRONMENT, SUSTAINABILITY INDEX* and *KNOWLEDGE of PREVENTION of VAP, CRBSI and PU* as described in previous chapter. The socio-demographic information included nurses' age, qualification, role in the unit, length of service as nurse and length of service in the ICU. All the nurses working in the ICU between 3rd to 28th February 2010 were invited to participate in the study. Participant information sheets, surveys, and translation sheets were distributed to them by the ward managers. All surveys were returned to a box in the ward manager's office. The box was placed in the nurse manager office because the she was also involved in distributing the questionnaires to nurses. Participants were asked not to put their names on the questionnaires, therefore confidentiality of the participants were maintained.

5.6 Data analysis

Patients with complications and nurse survey were analysed using descriptive statistics. Interview data from key stakeholders were analysed thematically.[7] Further details described in Chapter 4.

5.7 Findings

5.7.1 Environmental scan

The environmental scan and interviews with stakeholders identified key barriers and facilitators to ICU change (Table 5.2). Four interviews conducted included discussions with the head of department of the ICU, intensivists, and two nurse managers. Each of these discussants noted challenges such as the high demand for ICU beds, limited resources and high patient turnover rate. Some 'eligible' patients were denied admission due to an absence of beds and had to be ventilated in other units and be cared for by lesser trained staff in the wards. This caused stress and frustration to both the medical and nursing staff.

The CDC guidelines were being used by the medical staff for diagnosis of VAP and CRBSI, but the nurses were unfamiliar with them. However, the ward managers insisted that the nurses were already exposed to VAP and CRBSI except PUs risk assessment tool. The nursing management required the use of a nursing care plan which includes documenting PU (assessment, planning and evaluation). However, an absence of standard data collection to capture individuals at high risk of complications was noted. A division between nursing and medical guidelines was also recognised.

Other problems identified during the interviews included staff's persistent reluctance to accept any change proposed in the unit not only change for this study; inadequate nursing staff leading to high workload; communication problems with medical officers; equipment not properly maintained, such as patient beds; and lack

of information technology resources, including computers and internet access. Access to electronic databases for searching the literature was only available in the hospital library.

Importantly, the medical clinicians were eager to engage and empower nurses to control and monitor their practice and recognise the critical role of nursing care in preventing adverse events in the ICU. Conversely, the nurses noted the hierarchical organisational structure, yet appeared to be accepting and passive in maintaining existing roles.

Table 5.2 Barriers, facilitators, and actions identified through key informant consultation and interviews

Barriers	Facilitators	Actions
No routine data monitoring process for PU	.	Implement routine validated measures, e.g., Waterlow Pressure Ulcer Risk Assessment.
	Executive leadership and support	Engage project advisory team. Regular consultation and update.
High bed demand and limited resources		Incorporate strategies to improve in nursing practice. Use supporting data to request additional resources.
Introduction of additional workload through increased attention on surveillance	Executive leadership and support	Engage and empower clinicians in monitoring their practice. Work with executive leadership to endorse project strategies. Provide regular feedback to demonstrate utility of data collection.
Staff reluctance to engage in change process	Executive leadership and support	Provide regular feedback for staff. Provide resources, such as evidence-based practice journals. Reinforce best practices. Provide information related to career advancement.
	Research advisory committee	Screening instrument to facilitate communication between staff.
Inadequate feedback for staff	Executive leadership and support	Provide current information on unit status such as effectiveness of infection control. Ensure all information is accessible to staff.
Need for leadership endorsement	Executive leadership and support	Encourage reflective practice. Support nurses in leadership development.
Inefficiency in use of nursing process	Executive leadership and support	Maintain documentation if there is proper facilitation. If not, abolish unnecessary / redundant documentation.
Hierarchical organisational structure		Engage in planning projects. Support nurses in assessing and communicating clinical findings.

5.7.2 Patient characteristics

Twenty-one cases of ICU complications were identified in 18 of the 91 patients (19.8%) admitted in December 2009 (Table 5.3). Of the patients, three developed two complications - PU and VAP (two patients), and PU and CRBSI (one patient). Approximately 89% were medical admissions and 15 (83.3%) were male. Of the patients with complications, 16 (88.8%) were recorded to have at least one co-morbidity before admission. Only three (16.7%) of those who developed an ICU complication were discharged alive from the hospital, the rest dying either in the ICU or ward. The mean SOFA and SAP II score were 8.1 (SD 3.9) and 46.3 (SD 18.1) respectively.

Table 5.3 Characteristics of patients with ICU more complications

Characteristic (n=18)	n	%	Mean (SD)
Case (n=18)			
Medical	16	88.8	
Surgical	1	5.6	
Head 1njury	1	5.6	
Sex			
Male	15	83.3	
Female	3	16.7	
Age (Years)			57.3 (15.8)
Glasgow Coma Scale (GCS)			7.38 (4.96)
Charlson Comorbidity Score			3.24 (1.97)
Simplified Acute Physiology (SAP II)			46.3 (18.1)
Sequential Organ Failure Assessment (SOFA)			8.1 (3.9)
Risk of Hospital mortality			44.8 (23.5)
Length of ICU stay (Days)			12.2 (7.1)
Length of ward stay (Days)			7.2 (9.6)
Condition on transfer from ICU (n=18)			
Dead	7	38.9	
Alive	11	61.1	
Condition on transfer from ward (n=11)			
Dead	7	63.6	
Alive	3	27.3	
Still in the ward	1	9.1	
Type of complication (n=21cases)			
VAP	4	19.0	
CRBSI	1	4.8	
PU	16	76.2	

CRBSI-Catheter Related Blood Stream Infection
ICU- Intensive Care Unit
PU-Pressure Ulcer
VAP-Ventilator-Associated Pneumonia

5.7.3 Nurse survey

There were 83 nurses, of which five were ward managers, three acute pain service nurses and 75 nurses working in the ICU at the time of data collection (Table 5.4). Two of these nurses reported post-basic critical care qualifications. A total of 81 nurses were invited to participate in the study and 75 accepted generating a response rate of 92.6%.

Table 5.4 Nurse participant characteristics

Characteristic (n=75)	n	%	Mean (SD)
Gender			
Male	1	1.4	
Female	74	98.6	
Age (Years)			40.8 (21.3)
Length of service as a nurse (Years)			9.2 (6.2)
Length of service in ICU (Years)			5.9 (5.0)
Occupation			
Ward manager	2	2.7	
Registered Nurse	73	97.3	
First Nursing Qualification			
3 years' certificate	6	8.0	
3 years' diploma	69	92.0	
Highest nursing qualification			
3-year certificate	1	1.3	
3-year diploma	46	61.4	
Post-basic critical care	27	36.0	
Bachelor degree	1	1.3	

ICU- Intensive Care Unit

Professional Practice Environment

Evaluation of staff's perceived level of positive regard for their practice environment was conducted using the RPPE scale. The possible range mean scores were 1 to 4. The highest cumulative mean scores within the eight components were for *Internal Work Motivation* (M 3.24; SD 0.3), *Relationship With Physician* (M 3.22; SD 0.53) and *Cultural Sensitivity* (M 3.04; SD 0.24). Only three components had mean scores of ≥3 and five <3. The two lowest mean scores were for *Handling Disagreement* and *Teamwork* with 2.77 (SD 0.16) and 2.45 (SD 0.47), respectively (Table 5.5).

Table 5.5 Revised professional practice environment (RPPE) scores

Component (n=75)	Agree %	Disagree %	Mean	SD
1. Handling disagreement and conflict			**2.77**	**0.16**
When staff disagree, they ignore the issue, pretending it will "go away"*	42.7	57.3		
Staff withdraw from conflict	45.3	54.7		
Disagreements between staff members are ignored or avoided*	69.3	30.7		
All contribute from their experience, expertise to effect high-quality solution	98.7	1.3		
All staff member work hard to arrive at the best possible solution	98.7	1.3		
All points of view considered in finding best solution to problem	81.1	18.9		
Most conflicts occur with members of my own discipline	87.8	12.2		
Staff involved do not settle the dispute until all are satisfied with decision	47.3	52.7		
Staff involved in a disagreement or conflict settle the dispute by consensus	94.6	5.4		
2. Leadership and autonomy in clinical practice			**2.93**	**0.43**
Department head supports staff even if conflict is with a physician	69.3	30.7		
Leadership is supportive of my department/unit staff	82.7	17.3		
Department head is a good manager and leader	90.5	9.5		
My discipline controls its own practice	98.7	1.3		
I have freedom to make important patient care and work decisions	82.4	17.6		
3. Internal work motivation			**3.24**	**0.30**
I have challenging work that motivates me to do the best job I can	100	0		
Working in this unit gives me opportunity to gain new knowledge and skills	100	0		
I feel a great sense of personal satisfaction when I do my work well	98.7	1.3		
I feel a high degree of personal responsibility for the work I do	100	0		
Working in this environment increases my sense of professional growth	92.0	8.0		
I'm motivated to do well because I'm empowered by my work environment	98.7	1.3		
My opinion of myself goes up when I work in this unit	90.7	9.3		
I feel bad and unhappy when I discover I performed less well than I should	84.0	16.0		
4. Control over practice			**2.82**	**0.35**
There are enough staff to provide quality patient care	74.7	25.3		
We have enough staff to get the work done	52.0	48.0		
I have enough time and chance to discuss patient care problems with other staff	86.7	13.3		
I have adequate support services to allow me to spend time with my patients	84.0	16.0		
There are opportunities to work on a highly specialized patient care unit	98.7	1.3		
5. Teamwork			**2.45**	**0.47**
Inadequate working relationships with other hospital groups limit effectiveness of work on this unit.*	66.7	33.3		
My department does not get the cooperation it needs from other hospital units*	57.3	42.7		
Other hospital units/departments seem to have a low opinion of my department*	34.7	65.3		
My department has constructive relationships with other groups in this hospital	74.7	25.3		
6. Staff relationship with physicians			**3.22**	**0.53**
Physicians and staff have good working relationships	93.3	6.7		
There is a lot of teamwork between unit/department staff and doctors	93.3	6.7		
7. Cultural sensitivity			**3.04**	**0.24**
Staff members are sensitive to diverse patients populations for whom they care	100	0		
Staff respect the diversity of their health care team	93.3	6.7		
Staff have access to necessary resources to provide culturally competent care	98.7	1.3		
8. Communication about patient			**2.95**	**0.20**
I receive information quickly when a patient's status changes	89.3	10.7		
Information regarding patient care is relayed without delay	96.0	4.0		
Information on the status of patients is available when I need it	90.7	9.3		

* Reverse item- Disagree indicates more positive professional practice environment

Sustainability

The Sustainability Indices ranged from 13.4 to 100 with a mean of 75.21 (SD 21.71) (Table 5.6). Approximately 84% of the nurses had mean scored >55, indicating optimism for change.

Table 5.6 Sustainability scores

	Stage (n=75)	Mean	SD
	Process	**24.17**	**7.75**
1.	Benefits beyond helping patients	7.49	2.53
2.	Credibility of the benefits	7.13	2.46
3.	Adaptability of improved process	5.47	2.10
4.	Effectiveness of the system to monitor progress	4.08	2.68
	Staff	**39.23**	**12.05**
5.	Staff involvement and training to sustain the process	7.11	3.33
6.	Staff attitudes toward sustaining the change	7.15	4.40
7.	Senior leadership engagement	12.82	4.58
8.	Clinical leadership engagement	12.15	4.60
	Organisation	**11.81**	**4.41**
9.	Fit with the organisation's strategic aims and culture	3.94	2.49
10.	Infrastructure for sustainability	7.87	2.97
	Total mean score 75.21 SD 21.71		

Knowledge score

The nurses' knowledge scores ranged from 74 to 140 which indicates good knowledge scores with mean of 124.84 (SD 14.66). The majority (n=66; 88%) mean scored >80 while 5.3% mean scored ≤60. Table 5.7 shows the mean score for each knowledge item.

Table 5.7 Knowledge scores

	Knowledge (n=75)	Mean	SD
1.	Hand washing is important to prevent cross infection	9.57	1.23
2.	Alcoholic antiseptic solution is recommended compared to soap for hand washing	8.16	1.94
3.	Regular positioning of patients can help to prevent VAP and pressure ulcers	8.21	1.91
4.	Elevation of the head of bed > 30 degrees is recommended for all ventilated patients	9.13	1.30
5.	Chlorhexidine is recommended for oral care and disinfection in prevention of VAP and CRBSI	8.60	1.59
6.	Enteral nutrition should be started immediately for all ventilated patients with no contraindication.	9.33	1.18
7.	Maximal barrier precautions are recommended to prevent infections in ICU.	9.09	1.20
8.	Early mobilization reduces ICU complications	8.80	1.05
9.	Subglottic suctioning can prevent microaspiration in ventilated patients.	8.19	1.84
10.	Blood or tracheal secretions culture and sensitivity is recommended if patient shows signs and symptoms of infection	9.25	0.89
11.	Exposure to evidence based practice can help nurses to prevent VAP, CRBSI and pressure ulcer	9.31	1.24
12.	Hygiene care help to reduce infection for ICU patients	9.57	1.22
13.	Assessment of pressure area is indicated for all ICU patients	9.24	1.06
14.	Each patient shows specific signs and symptoms if he/she develops VAP and CRBSI	8.91	1.68
	Mean knowledge score 124.84 SD 14.66		

ICU- Intensive Care Unit
CRBSI- Catheter Related Blood Stream Infection
VAP- Ventilator-Associated Pneumonia

5.8 Discussion

The mixed method approach used in this study allowed a multifaceted view of the barriers and facilitators to clinical practice improvement in the ICU. The findings provide an insight into the system, patients and provider factors impacting on clinical practice in the ICU. The findings from the environmental scan indicated that this ICU had a high case load due to the high bed demand, as demonstrated by its 70 to 90 admissions a month for only 16 beds. Many patients who needed admission had to be cared for in the general wards due to the unavailability of beds.

Of the patients with complications only one patient was detected with CRBSI during the baseline data collection. This may be due to this ICU routinely practising removal of the catheter immediately prior to sending any blood cultures from the central catheter lumen and peripheral line. (ICU Ward Manager, Personal communication, 5 March 2010). Therefore this might had contributed to low number of CRBSI detected.

The mean length of ICU stay for patients with the ICU complications was 12.2 day however the Malaysian Registry of Intensive Care[8] has reported the mean length of ICU stays for patients in this ICU was 4.3 days in 2009. The increased length of stay may be attributed to the complications that were developed in the patients studied.

The mean scores for disease severity of patients who developed VAP, CRBSI or PU were higher than the averages from the Malaysian ICU Audit, 2003 - 2008. In this study, the mean SAP II was 46.3(SD 18.1) and mean SOFA 8.1(SD 3.9). According to Le Gall, Lemeshow, and Saulnier,[9] SAP II is an extremely effective estimation of the probability of mortality for ICU patients. SOFA was highly predictive of survival applied on their first admission to the ICU.[10, 11] A study on early predictors of mortality in trauma patients found that ICU mortality was 7.9% with a fairly high degree of illness as indicated by the SOFA admission score of 5 to 7.[12] Ferreira and colleges[11] also found that highest SOFA score correlated with

mortality: highest scores of 10 correlated with a mortality rate of 40% while higher than 11 were associated with a mortality rate greater than 80%.[11]

Approximately 78.8% of the patients in this study who developed at least one of the three complications died. The high mortality rate in these patients was reflected in the mean SOFA score of 8.1(SD 3.9). According to Ferreira et al. [11] the mean SOFA score over the entire ICU stay was also correlated with mortality.[11] They found that 32 patients in their study with mean SOFA score >5.1 had mortality rate greater than 80%. The method for calculating SOFA score is easier and simpler to predict group mortality for ICU patients with the sensitivities, specificities, accuracies of 58.5%, 99.6%, and 91.1%, respectively.[13]

The findings were that although the nurses had good knowledge of prevention strategies, the prevalence of VAP, CRBSI and PU suggested the need for quality improvement strategies. A study in three ICUs across Malaysia on the practice of oral care for ventilated patients (which included this study ICU) found similar results.[14] In a study by Soh et al., there were discrepancies between self-reporting and observed practice.[14] In contrast, Biancofiore[15] found that the majority of nurses in Italy reported a lack of knowledge in VAP prevention strategies, yet were observed undertaking these tasks.

This unit has inadequate resources such as computers. Two computers were available but only one computer had internet access and access was only available to medical clinicians. There are limited number of nurses with baccalaureate education suggests that there may be knowledge and skill barriers to implementing EBP. Although not specifically investigated in this study, the nurses may also have limited data retrieval skills and may not be able to retrieve information and evaluate it even if allowed full access to the electronic sources. Smith and Donze[16] reported that the most important physical resource to learn and practice EBP is computer access to textbooks and online journals. Pravikoff, Tanner and Pierce[17] surveyed 760 nurses in the US and found that the majority did not understand or value research, and were generally unprepared for a practice built on evidence. Most nurses believed that they were not adequately prepared to appraise research and interpret relevance for clinical

decision making. They also indicated the lack of access to electronic information databases or internet in the workplace

Evaluation of the likelihood of sustainability showed a positive attitude to the change process. The survey feedback indicated that nurses had positive attitudes toward the change process proposed to decrease rates of ICU complications - the mean score on the Sustainability Index was 75.21(SD 21.71). This indicates that the chance of introducing and maintaining the proposed changes was very high with 84% of the participants scoring >55. The nurses felt enthusiastic about new practices if they (practices) can be incorporated in their routine work. Soh et al.[14] had previously found that the nurses in this ICU would implement oral care procedures for patients if the practice was integrated into their routine.

The majority of nurses had high positive regard for their professional practice environments with a mean score of >3 with possible range of 1 to 4 for *Internal Work Motivation*, *Staff Relationship with Physicians* and *Cultural Sensitivity*. However, *Handing Disagreements or Conflicts*, *Leadership and Autonomy in Clinical Practice*, *Control over Practic*e, *Teamwork* and *Communication About Patients* scored < 3 indicating their disagreement. These findings were affirmed in the discussions undertaken as part of the environmental scan.

The nurses in this study felt a lack of control over their practice and had difficulty handling conflict. A perception of lack of autonomy in clinical practice may be related to the historical emphasis on dependent nursing practice and the hierarchical structure in delivery of health care.[18]

The low mean score for *Teamwork* may be related to the hierarchical administrative structure in the ICU and the limited opportunities to discuss and debate patient care issues. Furthermore, all patients referred to this hospital were transferred from the Emergency Department to ICU. Therefore, in the subscale for *Teamwork*, 75% of the nurses felt that they had constructive relationships with other groups in the hospital. Within the ICU 93.3% of the nurses reported there is a lot of teamwork in the unit and working relationship with the doctors.

This result was comparable to the study by Charalambous, Katajisto, Välimäki, Leino-Kilpi, and Suhonen[19] in 13 wards in three Finnish acute care hospitals. Although their study was not specifically conducted in ICUs, the mean responses for 5 of 8 subscales were above 3 and the remaining 3 subscales scores 2.39 (C*ontrol over Practice*) 2.85 (*Teamwork)* and 2.72 *(Handling Disagreement and Conflict*). Two subscales such as such as *Leadership and Autonomy in Clinical Practice* and *Communication About Patients* although above three (3.04, 3.03). This may indicated that nurses may have different perception about their practice environment.

This study has provided important baseline information for future quality improvement initiatives and important insight into the barriers and facilitators driving clinical change. Appraising an organisation's readiness and identification of the drivers is crucial in implementing acceptable and appropriate interventions. The use of the mixed methods approach enabled assumptions to be validated and elucidated factors crucial in implementing intervention changes to improve patient outcomes. The following factors were identified as important to consider during the intervention such as nurses *Lack of Control over Their Practice, Handing Disagreements or Conflicts*, *Leadership and Autonomy in Clinical Practice*, and communication problem with medical officers. The low number of nurses with a baccalaureate education, the absence of nursing research, and minimal experience with nurse-led practice solutions were also important to consider in moving forward with the project.

5.9 Conclusions

Preventing complications in the ICU is a critical issue challenging health care providers to assess and reflect on their capacity to deal with this problem. The environmental scan identified the high workload in the ICU and the risk of developing ICU complications. The assessment of organizational readiness found that nurses are committed to improving patient outcomes and have good knowledge

on infection control prevention. However, respondents revealed a lack of control over their practice and also *Handing Disagreements or Conflicts*. Nurses work in a high-pressure environment, have limited access to information resources and are cast in a hierarchical structure unsupportive of autonomy and independent practice. Addressing these factors is crucial to implementing interventions to improve patient outcomes. This also underscores the value of using an action research process that focuses on empowerment and control over the research and practice setting.

On reflection of the baseline study findings the nurses felt they have lack of control over their practice and difficulty handling conflict which can be due to hierarchical structure in the organisation. The next step of the action research study was to empower nurses to take control of their practice by changing their routine nursing practice to evidence-based recommendation.

This chapter has provided a baseline overview of the study setting. Focus group discussions were conducted to provide greater understanding of the barriers and facilitators of change in EBP. The following chapter will report, in more depth, the problems related to implementing EBP in the ICU practice setting.

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CHAPTER 6

PHASE 2: NURSES' PERCEPTIONS OF STANDARDISED ASSESSMENT AND PREVENTION OF ICU COMPLICATIONS

CHAPTER 6
PHASE 2: NURSES' PERCEPTIONS OF STANDARDISED ASSESSMENT AND PREVENTION OF ICU COMPLICATIONS

6.1 Introduction

Chapter 5 has provided baseline information on the intensive care unit (ICU) professional practice environment, nurses' knowledge level about prevention of ventilator-associated pneumonia (VAP), catheter-related blood stream infection (CRBSI), pressure ulcer (PU), sustainability of the change process and patient characteristics of those who developed ICU complications. This chapter provides a description of nurses' perception of VAP, CRBSI and PU assessment and prevention strategies as part of the intervention. These data were derived through focus groups.[1] Methodological considerations are provided in Chapter 4.

6.2 Nurses' adherence to evidence-based practice

The importance of implementing evidence-based practice (EBP) in the healthcare system by health care practitioners has been emphasised.[2, 3] Practitioners are expected to apply EBP from reliable and valid research. However, the implementing these strategies is not easy. Many studies have been done on adherence to clinical guidelines by nurses in the Western world,[4-6] but not in Malaysia.

In order for nurses to provide evidence-based care, there is a need to understand the barriers and facilitators to implementation. Within interdisciplinary teams, nurses play important roles to support EBP environments and implementing change by stimulating collaboration and discussion between disciplines. [7]

Despite reported problems of nosocomial infections in ICUs globally and strategies introduced to address these barriers,[8, 9] little is known about Malaysian ICUs engaging in quality improvement initiatives. To date the majority of publications pertaining to Malaysian ICUs focus on reporting baseline surveillance of nosocomial infections, management strategies, antibiotic regimens and mortality rates.[10-12] This study will provide important information for implementing VAP, CRBSI and PU prevention initiatives for critically ill patients within Malaysian hospitals specifically and more broadly quality improvement initiatives. Therefore, it was considered that understanding nurses' perceptions of the change process were not only critical for the INVEST Study but also for understanding factors impacting on EBP in the study setting.

6.3 Aim

The aim of this phase of the action research cycle was to describe Malaysian nurses' perceptions of implementing evidence-based recommendations to prevent complications in the ICU. This phase of the study addressed the following research questions:

- What are the factors that impact upon VAP, CRBSI and PU assessments?
- In what way do nurses perceive change processes in the ICU?
- In what way can nurses facilitate the sustainability of change processes in the ICU?

6.4 Methods

6.4.1 Design

A qualitative approach using focus group discussions was implemented. A total of eight focus groups were undertaken with two to six participants sharing their perceptions through a facilitated discussion.[1] Further detailed are described in Chapter 4.

6.4.2 Setting and participants

This study was conducted in May to June 2010 in a medical / surgical ICU in a Ministry of Health hospital in regional Malaysia; the only public critical care referral centre in the state. The participants were nurses working in the ICU on a particular day were invited to participate in focus groups by the ICU nurse manager and researcher during day shifts. Further details on study setting and participant characteristics are presented in Chapter 4.

6.4.3 Data collection

Focus group discussions with nursing staff were conducted to obtain their views on incorporating VAP, CRBSI and PUs assessment tools into their daily practice as described in Chapter 4. The discussions were during the day shifts for 30 to 60 minutes. All the available participating nurses (n=34) were invited to attend the discussions conducted predominately in Bahasa Malaysia and English by the researcher. A participant was allowed to attend more than one focus group if they wanted to share other issues pertaining to the study. However due to the fact that the focus groups were conducted during their shifts each participant only attended once, this also allowed other nurses the opportunity to take part in the discussion. The topics discussed included how the nurses and their colleagues felt about implementing the VAP, CRBSI and PUs assessment tools, any barriers that they are likely to experience in implementing the tools, and potential solutions to the barriers.

6.5 Data coding and analysis

A reflective and iterative process was used during data analysis. Further details of data analysis and coding are described in Chapter 4.

6.6 Findings

Approximately 50 potential participants were approached during their shift work. Eight focus groups with a total of 34 (n=83) participants were undertaken. The participant characteristics are presented in Table 6.1. The main reason given for not participating was being *too busy*.

Table 6.1 Focus group participant characteristics

Characteristic (n=34)	n	%	Mean (SD)	Range
Age (Years)			31.62(5.0)	24 to 44
Length of service as registered nurse (Years)			7.46(4.1)	2 months to 17
Length of service in ICU (Years)			3.67 (4.0)	1 week to 16
First nursing qualification				
3-year diploma	34	100		
Highest nursing qualification				
3-year diploma	24	70.6		
Post-basic critical care	9	26.5		
Bachelor degree	1	2.9		

ICU- Intensive care Unit

Themes that emerged from the discussions included: [1] nurses' knowledge impacts on the change process; [2] initial resistance, ambivalence and movement to acceptance of change by nurses; and [3] hierarchical organizational structure hindering the change process. A summary of the sub themes, themes and illustrative quotations from the focus group discussions are listed in Table 6.2.

Table 6.2 Themes and quotations from the focus groups

Theme	Subtheme	Illustrative quotes
Nurses' knowledge impacts on the change process	**Knowledge gap on the disease process as well as determining the different assessment tools provided for the practice change and existing documentation**	Kind of hard to know (detect VAP) because we remember that when there is infection all patients will show sign of increased body temperature and total white blood count, so we cannot differentiate whether the infection is general infection or it related to VAP. [Interview 3:18] ... if we want to predict pressure sore the unit already have a book on the pressure sore audit [Interview 1:32]
	Prioritising 'care' of patients over assessment of complications	Sometimes if too much work we also cannot remember to complete the Waterlow [Interview 5:51,118] Have to look at the ward situation, If not busy we can do. The 12 midnight evaluation, sometimes in morning only can complete [Interview 1:10]
	Rigid adherence to ingrained routine impedes change	Routine, if the patient admitted today after office hour, automatic tomorrow morning we take ETT secretions for culture and sensitivity [Interview 6:41]
Initial resistance, ambivalence and movement to acceptance of change	**Initial resistance to change**	They [assessment tools] feel like burden, if that night is busy...we can hear they are commenting / complaining. [Interview 1:18]
	Gradual acceptance of the change process	I think since we started until today, more people are doing it. Just on the admission one is missed, but for the midnight assessment we all do unless there is no form. Because during night duty we distribute together with the ICU chart for all patients in the ICU [Interview 1:82]
	Mastering the change process	At the beginning new thing is usually difficult to accept but when it is longer time it will becomes easier [Interview 3:71]

ICU- Intensive Care Unit
ETT-Endotracheal tube
VAP- Ventilator-associated Pneumonia

Hierarchical organizational structure hindering the change process	**Perceived and enacted deference/subservience to doctor**	If we want to take blood culture and sensitivity (C&S) from CVP, we don't have to inform Dr? [Interview 6:278] If ask the doctor to take blood C&S he/she will get angry just like the nurses want to order them [Interview 2:91.156] Some doctors listen to us but some do not [Interview 6:160]
	Hampering change via passive role/resistance of assertiveness	It is difficult here, if they come to ask only we tell. Because certain people, they think that if other people don't come to ask them that means they already knew (About the change implementation and how to use the assessment tools) [Interview 4: 135] …Reminding on and off because I think this place we need to push the people (to implement the change) [Interview 4: 156]
	Resistance / support of peer network	They (other nurses) boycott they will not help at all. Even we are right they cannot accept we are right [Interview 7: 234] Collaboration…helping each other not necessary it is my patient, I have to do it myself, other people also can do [Interview 1:14]

C&S- Culture and sensitivity
CVP- Central Venous Pressure
ICU- Intensive care Unit
VAP- Ventilator-associated Pneumonia

6.6.1 Nurses' knowledge impacts on the change process

The nurses' knowledge was a factor in incorporating change. Poor knowledge in the pathophysiology of conditions, such as VAP was found. The nurses also had difficulty discriminating between a prospective risk assessment as part of standard practice and a cross-sectional audit.

Participants did not appear to appreciate the value of standard methods of risk assessment in practice. From their statements, they did not consider assessing patients for complications to be part of 'care' or to be prioritised above other tasks. Their responses also reflected misconceptions. For example, as they routinely collect endotracheal secretions for culture and sensitivity test, they considered that assessing the risk of VAP was redundant.

6.6.2 Initial resistance, ambivalence and movement to acceptance of change

Emerging from the data was evidence of an initial ambivalence and skepticism to the changes proposed. After some time, individuals moved to acceptance and resignation of the change process. Nurse said that during night shift they distribute the Waterlow forms to everybody and helping each other to complete the assessment if one of them is busy. Some nurses were optimistic that they will eventually master the change.

6.6.3 Hierarchical organisational structure hindering change

Data revealed that the hierarchical structure of the workplace hindered change, possibly due to the subservient role of nurses. According to the nurses, some doctors dislike nurses asking them (doctors) to do even minor tasks, such as taking blood for culture and sensitivity test. Therefore, they (nurses) had a problem sending the blood culture and sensitivity sample from the patients' peripheral vein for CRBSI diagnosis.

The nurses in the study were not confident to work independently of the doctors to, for example, take blood without their knowledge / consent. They felt that even asking the doctor to do a simple task, such as taking blood for a blood culture in suspected CRBSI was not appropriate.

In addition, resistance through complying with peer pressure and hierarchical forces was also noted. One junior nurse said she needed to follow the senior nurse's instruction to gain clinical experience because she (junior nurse) had just completed her post basic critical care course. She did not want to upset her senior by leaving her work, however temporarily, to attend the focus group which was being conducted at that time. Another nurse also said that peer pressure is a very common problem in the unit. She herself was reluctant to tell the other nurses to change, even the junior ones, because she may be left to attend to her patient alone without help from any of her colleagues.

6.7 Discussion

There is growing pressure to reduce common healthcare-associated infections because of their major economic and clinical impacts.[13-15] Of all ICU complications, the nosocomial infections are the most preventable.[16] For this, the Centers for Disease Control and Prevention (CDC) recommends a set of EBP for basic nursing care.[7] This study focused on identifying the problems in implementing measures for infection prevention in the ICU by using focus group discussions among the nurses. The data reported above were formative in the action research process,

The main factor impacting utilization of VAP, CRBSI and PU found in the focus group discussions was related to nurses' knowledge. Nurses in this setting were unaware the importance of standard assessments in their daily practice. They did not have a high level of understanding of the importance of standard risk assessment. A survey in two hospitals in Malaysia on allied health practitioners' (*n*=52) perception of EBP found that 61% felt its importance to be exaggerated and 46.2% found it too tedious and impractical.[17] The authors also found that the 60% of

the participants valued human views and experiences more than research evidence.[17] The findings from this project cycle tend to suggest this is also the case for nurses, at least in this study setting.

One nurse had difficulty differentiating between general infection process and the infection cause by VAP. Theoretical knowledge is crucial as a linkage to EBP. A surveyed found 50% (*n*=26) of allied health practitioners in Malaysia found it hard to relate research findings to patient care.[17] Therefore, they may have had difficulty in applying EBP to their daily practice. Internationally, two surveys on nurses' knowledge about evidence-based guidelines on prevention of CRBSI[18] and VAP[19] found average scores of 44% and 45%, respectively. Whether the low scoring was associated with a lack of knowledge, deficiencies in training, differences in what is regarded as good practice, and/or a lack of consistent policywas unable to be determined.[19]

The impact of the colonial period remains as nursing in Malaysia generally evolves and remains similar to the British system.[20] The majority of the nurses are diploma level and have hospital-based qualification. Currently the demand for degree education is increasing. The post-registration conversion degree (two years) and undergraduate nursing degree programme (four years) are offered by both public and private universities. Post–registration conversion programme provides opportunities for nurses to upgrade from hospital-based nursing qualification or diploma level to the degree level. [21]

The authorities in Malaysia have increased the intake of nursing students in both public and private institutions due to shortage of nurses.[22] As universities and colleges compete for the same pool of high school graduates, some concern has been expressed that entry standards may fall (Barnett et al. 2010). Furthermore, some of these high school graduates may enter nursing not as a career decision, but rather as an opportunity to leave home at younger age.[23] This may mean that their motivation and application in clinical practice maybe lacking professional drive. Over 71% of the nurses interviewed in this study were diploma holders, and many considered their qualification sufficient to work in the complex environment of the ICU. In the focus

group discussion, one of the participants also admitted that she needed prompting from time to time to make sure that the change of practices were implemented.

The Malaysian Ministry of Health introduced the "7S then increased to 10S soft skills" behavior change program to enhance the professional attitude of nurses and to improve patients and the public satisfaction as one of the performance indicators.[24, 25] The 7S and the 10S concept were developed to improve the soft skills among nurses working with the Ministry of Health.[26] This concept also aims to instill corporate culture to nurses combining with their clinical skills to improve quality care.[26]

The values and views presented above are likely not exclusive to Malaysian nurses. Internationally, nurses are undergoing increased scrutiny and educational preparation is an easy scapegoat for failing health care systems.[27] Further, as nurses increase their power over their practice there may be pushback particularly in the context of a hierarchical health care system. Responsibility has been placed on nurses individually rather than on the structural, social and political determinants of care such as working condition, shortage of staff or lack of support for staff.[23] The views espoused above can be viewed as being detracting to promoting autonomous practice and nurse-led interventions.

Other factors identified influencing the change acceptance included the relationship between nurses and doctors was identified as a factor hindering nurses from adopting change. The nurses explained that some doctors disliked nurses asking them to do things, even small tasks such as taking blood, because historically, nurses are just hand maidens to the doctors.[28] Doctors and nurses frequently experience difficulties in working together; partly because of the power relationship between the professions is not symmetrical.[29, 30] Some doctors still think that nurses are just there to receive orders from them, and so are averse to undertaking any tasks requested by them.[28, 31] A study on occupational stress among nurses at Northern Ireland found that a factor leading to high occupational stress is a lack of autonomy in decision making.[32] Eighty-five percent of their participants felt powerless without the ability to change unsatisfactory situations.[32] Both articles discussed above were

published in 1980s and the possibility that things might have changed has been acknowledged. A study in Australia found that collaboration can break down when physicians dismissed nurses' clinical assessments of patients contrary to theirs.[33] However, if the nurses' assessments are supported by the patient symptoms, the collaboration can be smooth, but not vice versa.[33]

Although many studies have reported on the relationship between doctors and nurses impacting on the change process internationally,[34, 35] there are only limited studies in Malaysia. One study found that nurses in Malaysia faced several barriers, e.g., lack of recognition, unfavourable conditions of employment and gender inequality.[36] With the current shortage of nurses, their work problems have to be addressed to improve the attraction of the profession, and this would include allowing their clinical judgment[37] as well as diagnosing and making recommendations to improve patient care.

Despite the initial reluctance of many nurses to adopt change and the challenges of the doctor-nurse relationship, the focus groups revealed that some nurses were optimistic that change will get easier with time and eventually be smoothly introduced into their daily clinical routine. They were confident during the focus group. They discussed about the change process and appreciated the knowledge that they had gained from the INVEST Study. They were aware of using the introduced assessment tools in their daily practice and also were positive about future changes. Participants indicated that they were looking forward to the opportunity to improve. According to Vandijck et al.[7] nurses who are aware of the reasons for change are more likely to succeed in adopting the change. Supporting these early adopters can be a catalyst for changing the whole practice environment.

6.8 Limitations

Although valuable insight was gained into process issues, the study had limitations in generalising findings to other populations. The limitations inherent in focus group designs are acknowledged, particularly, the purposive sampling undertaken. The purposive sampling methods and data collection mean that the findings from this study may not be extrapolated to other settings. Further, the participants may not have expressed conflicting views due to concerns about retribution, particularly in their hierarchical workplace. In order to minimise this potentially significant factor, at the beginning of the interviews the confidentiality and anonymity of the participants was reinforced by researcher.

6.9 Recommendations

The findings of the focus groups have suggested a need to address nurses' knowledge and attitudes towards change in order to implement EBP in the ICU. The findings are consistent with other studies undertaken in Malaysia.[17, 23] These studies have underscored the importance of undertaking educational activities to promote EBP. Promoting changes in the work-based culture change, including controlling practice and driving improvement need to be emphasized. Based upon these data for the INVEST project it was identified that for future studies to drive practice change additional information and intensified education and support will be required.

6.10 Conclusion

Complications in the ICU are challenging health care providers to assess and reflect on their ability to deal with the problem. On reflection of the findings from these focus groups there was a need to improve nurses' knowledge, attitude and awareness on the importance of systematic assessment for VAP CRBSI and PU. Although in the survey nurses portrayed good knowledge on prevention of ICU complications however they still need to improve their knowledge on basic sciences

and EBP. Knowledge of the basic sciences and the importance of research to improve practice were identified as being important. Implementing strategies to increase nurses' critical evaluation of clinical practice, individually and collectively as well as promotion of team work were identified from this study phase as being important in improving clinical outcomes in the ICU.

This chapter has provided qualitative data on implementing EBP in this ICU among the nurses. It has also underscored the importance of considering cultural factors and dynamics as well as providing information in driving practice change. This information was critical for structuring information and tailoring strategies in implementing the project aims. The next chapter will report the comparison of pre and post INVEST intervention results.

6.11 References

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CHAPTER 7

PHASE 3: COMPARISON OF PRE AND POST INTERVENTIONS FINDINGS

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7.1. Introduction

Chapter 6 has described the perception of nurses as to the barriers and facilitators of ventilator-associated pneumonia (VAP), catheter related blood stream infection (CRBSI), pressure ulcer (PU) assessment and prevention in intensive care unit (ICU). This chapter provides a pre and post intervention analysis of VAP, CRBSI, PU and nurse survey.

7.2 Aim

This study sought to assess the impact of an intervention focusing on preventing three major ICU-related complications: VAP, CRBSI and PU in a Malaysian ICU.

7.3 Methods

7.3.1 Study design

The study was conducted in December 2009 to June 2011 using an action research approach including patient profiling and a nurse survey to evaluate the effect of a clinical practice improvement initiative in ICU as previously described.[1] A non-experimental pre-test post-test design was used to determine the impact of the intervention. The pre-intervention (baseline) period was measured in four weeks (December 2009).

The intervention phase ran from February to July 2010. During this period staff education and the VAP,[2] CRBSI[3] and PUs[4] assessment tools were integrated into nurses' daily practice. This intervention involved education, circulation of assessment tools and evidence-based articles, flyers, feedback on hand hygiene practices, and 30 degree head of bed measuring sticks were provided for accurate measurement of head of bed elevation. Further details of the interventions are described in Chapter 4.

The evaluation phase was conducted in about four weeks (March 2011) after a seven month "cooling off" period to evaluate the sustainability of change in clinical practice. This cooling period was allowing for the changes to be enacted and become embedded in nursing practice. In this period patient profiling and a nurse survey was conducted to evaluate the effect of a clinical practice improvement initiative in ICU. The pre-test /post test periods were short (4 weeks) to allocate longer time for interventions and the cooling period.

7.3.2 Study setting and participants

This study was conducted in a medical / surgical ICU in a Malaysian Ministry of Health hospital. There were 83 and 87 nurses working in the ICU during pre and post intervention period. Further details are provided in Chapter 4.

7.4 Quantitative data collection

7.4.1 Patient profiling

In the pre-intervention group all patients admitted to the ICU were screened using the CDC diagnostic criteria for VAP[2] and CRBSI[3] in December 2009. All patients were assessed for PU during admission and every night shift until discharged from ICU.[4] Detected cases of VAP, CRBSI and PU were followed up by the researcher until the patients were discharged from hospital. This pre-intervention group provided the baseline information for the study.

The post-intervention group comprised all patients admitted to the ICU during March 2011 after a "cooling off" period. In this phase nurses were expected to be able to implement the CDC diagnostic criteria for VAP[2] and CRBSI.[3] However, as the medical team held responsibility for diagnosing VAP and CRBSI the Waterlow PU assessment form was used as a guide to determine the nurses' engagement in the change process. All detected cases of VAP, CRBSI and PU were followed up until discharge from hospital.

The recorded rate of VAP, PU and PU was reported in Chapter 2 and Chapter 5. Further details on the patient data collection form are provided in Chapter 4.

7.4.2 Nurse survey

All the nurses working in the ICU in February 2010 (pre-intervention group) and March 2011 (post-intervention group) were invited to participate in the study. Participant information sheets, surveys, and translation sheets were distributed to them by the ward managers. All questionnaires were returned to a box in the ward manager's office. The details of the nurse survey instrument are provided in Chapter 4.

7.5 Follow-up phase

During the intervention the nurses were followed-up individually or in a small group to identify problems and negotiate solutions occurring during the intervention. For example, based on discussion in the focus group, a small tag was provided for all nurses consisting of diagnostic criteria for VAP and CRBSI to facilitate assessment of these two complications. Focus groups identified barriers experienced by nurses in practicing prevention of VAP, CRBSI and PU. Briefly, these include lacked of knowledge on the basic sciences, lacked of awareness on the importance of systematic assessment for VAP CRBSI and PU, and the hierarchy structure of health professionals were identified as a factor hindering nurses from adopting the change.

7.6 Data analysis

Data from the survey and medical records were analysed using SPSS Version 19.0.1 Standard Version. A more detailed description of the data analysis plan is provided in Chapter 4. Briefly, the response rates and sample characteristics were analysed using descriptive statistics with the proportions (percentages) and/or measures of central tendencies. Chi- square was used to test for significant differences in the number of patient with PU and independent t-test was used to test nurses' level of knowledge on the strategies to prevent ICU complications in the pre- and post-intervention groups.

7.7 Findings

7.7.1 Patient characteristics

In the pre intervention phase 21 cases of ICU complications were identified in 18 of the 91 patients (19.8%) admitted during December 2009 (Table 7.1). Three patients developed two complications, PU and/or VAP (n=2) and/or CRBSI (n=1). Approximately 89% of patients were medical admissions to the ICU and 15 (83.3%) of 18 patients were male. Approximately 16(88.9%) of 18 patients with complications, were recorded as having a co-morbidity prior to admission. Of those patients who developed an ICU complication three (16.7%) were discharged alive from hospital, with the majority dying either in the ICU or on the ward.

Eleven cases of ICU complications were identified during the evaluation phase in 10 (8.7%) of the 115 patients admitted during March 2011 (Table 7.1). One patient developed both VAP and PU, while four developed VAP and another five PU. In this phase, no cases of CRBSI were detected. Of the patients reviewed 40% (n=4) were admitted due to motor vehicle accidents with a head injury and 80% (n=8) were male. Of the patients with complications, four (40%) were recorded as having co-morbidity prior to admission. Seven (70%) were discharged alive from ICU. There was an increase of VAP identification from four to five in the pre and post intervention phase. No CRBSI was detected in the pre intervention compared to one case in the post intervention period. The PU rate declined from 16 to six cases in the post intervention phase. The reduction of number of patients with the PU was statistically significance (χ^2=8.14, df=1, p=0.04).

The patients' severity of illness mean scores, SAP II and SOFA, for the post intervention group was 45 ± SD15.2 and 7.0 ± SD2.5, respectively. The results were slightly lower than for the pre-intervention group. Approximately 87 (75.7%) of the 115 patient medical records in the post intervention phase were found not to have a Waterlow pressure ulcer assessment form at all in the case notes.

Table 7.1 Pre- and Post-intervention patients with complications

Characteristic	Pre- (n=18)		Post- (n=10)		Pre-	Post-	*P value*
	n	%	n	%	Mean (SD)	Mean (SD)	
Case							
Medical	16	88.8	1	10.0			
Surgical	1	5.6	5	50.0			
MVA with head injury	1	5.6	4	40.0			
Sex							
Male	15	83.3	8	80.0			
Female	3	16.7	2	20.0			
Age (Years)					57.3(15.8)	48.6(20.0)	0.21
Glasgow Coma Scale (GCS)					7.4(5.0)	6.5(5.2)	0.49
Charlson Comorbidity Score					3.24 (1.97)	1.1(1.7)	0.01
Simplified Acute Physiology (SAP II)					46.3(18.1)	45.0 (15.2)	0.78
Sequential Organ Failure Assessment (SOFA)					8.1(3.9)	7.0(2.5)	0.49
Risk of Hospital mortality					44.8(23.5)	51.6(23.7)	0.56
Length of ICU stay (Days)					12.2(7.1)	19.5(13.4)	0.20
Length of ward stay (Days)					7.2(9.6)	15.1(9.5)	0.02
Condition on transfer from ICU							
Dead	7	38.9	3	30.0			
Alive	11	61.1	7	70.0			
Condition on transfer from ward							
Dead	7	63.6	1	14.3			
Alive	3	27.3	5	71.4			
Still in the ward	1	9.1	1	14.3			
Type of complication*							
VAP	4	19.0	5	45.5			0.99
CRBSI	1	4.8	0	0			0.26
PU	16	76.2	6	54.5			0.04

*p – value was determined by Chi-square, other was determined by t -test

CRBSI-Catheter Related Blood Stream Infection
ICU- Intensive Care Unit
PU-Pressure Ulcer
VAP-Ventilator-associated Pneumonia

7.7.2 Nurse survey

In the pre intervention group there were 83 registered nurses, including five ward managers, three acute pain service nurses and 75 nurses, assigned to the ICU at the time of data collection. Two were away attending a course on post-basic critical care. All the remaining 81 were invited to participate in the study with a response rate of 92.6% (n=75)

In post intervention group, there were 87 registered nurses, including five ward managers and three acute pain service nurses and 79 nurses. Three were away on a critical care course and one on maternity leave, leaving a total of 83 invited to participate in the study with a response rate of 92.8% (n=77) (Table7. 2).

Table 7.2 Pre- and Post-nurse participant characteristics

Characteristic	Pre- (n=75)		Post- (n=77)		Pre-	Post-
	n	%	n	%	Mean (SD)	Mean (SD)
Gender						
Male	1	1.4	1	1.3		
Female	74	98.6	76	98.7		
Age (Years)					40.8 (21.3)	33.9 (5.8)
Length of service as a nurse (Years)					9.2 (6.2)	10.0 (5.0)
Length of service in ICU (Years)					5.9 (5.0)	6.0 (4.7)
Occupation						
Ward manager	2	2.7	4	5.2		
Registered Nurse	73	97.3	73	94.8		
First Nursing Qualification						
3-year certificate programme	6	8.0	15	19.5		
3-year diploma programme	69	92.0	62	80.5		
Highest nursing qualification						
3-year certificate programme	1	1.3	4	5.2		
3-year diploma programme	46	61.4	34	44.2		
Post-basic critical care	27	36.0	36	46.8		
Post-basic infection control	0	0	1	1.3		
Bachelors degree	1	1.3	2	2.6		

ICU -Intensive Care Unit

The nurses reported a positive regard for their practice environment in the pre- and post-intervention groups with mean scores more than 2.5 except for *teamwork* in both groups (Table 7.3). The mean scores for each component were comparable for both the pre- and post-intervention groups except for *internal work motivation, control over practice and staff relationship with physician*. The highest mean scores within the eight components for the post-intervention group were for *internal work motivation* (M 3.13; SD 0.27), *relationship with physician* (M 3.04; SD 0.33) and *cultural sensitivity* (M 3.01; SD 0.23). The three lowest were for *handling disagreement and conflict* (2.80; SD 0.20), *control over practice* (2.71; SD 0.34) and *teamwork* (2.48; SD 0.31). An independent-samples t-test was conducted to compare before and after intervention total score for the eight components, and found significant differences in *internal work motivation, control over practice* and *staff relationship with physician* with *P* value less than 0.05.

Table 7.3 Revised Professional Practice Environment (RPPE) scores in pre- and post-intervention groups

Component	Pre- (n=75)		Post- (n=77)		
	Mean	SD	Mean	SD	*P* Value***
1. Handling disagreement and conflict*	2.77	0.16	2.80	0.20	0.20
2. Leadership and autonomy in clinical practice	2.93	0.43	2.93	0.24	0.88
3. Internal work motivation	3.24	0.30	3.13	0.27	0.03
4. Control over practice	2.82	0.35	2.71	0.34	0.05
5. Teamwork**	2.45	0.47	2.48	0.31	0.71
6. Staff relationship with physicians	3.22	0.53	3.04	0.33	0.01
7. Cultural sensitivity	3.04	0.24	3.01	0.23	0.29
8. Communication about patient	2.95	0.20	2.99	0.27	0.30

* Reverse item- Disagree indicates more positive professional practice environment one item
** Reverse item- Disagree indicates more positive professional practice environment three items
*** p – value was determined by t -test

The Sustainability Indices ranged from 41.3 to 100% with a mean of 76.81±SD21.45 (Table 7.4). Approximately 84% of the nurses in pre-intervention and 70% in post-intervention scored >55%. An independent-samples t-test was conducted to compare before and after intervention total score for the three components, and found significant differences for organisation component, t (150) = -2.34, *P*.02.

Table7.4 Pre- and Post-intervention sustainability scores

	Stage	Pre-(n=75)		Post-(n=77)		
		Mean	SD	Mean	SD	*P* Value*
	Process	**24.17**	**7.75**	**24.34**	**6.74**	**0.88**
1.	Benefits beyond helping patients	7.49	2.53	6.85	2.04	
2.	Credibility of benefits	7.13	2.46	7.45	1.64	
3.	Adaptability of improved process	5.47	2.10	4.99	2.18	
4.	Effectiveness of system to monitor progress	4.08	2.68	5.05	2.27	
	Staff	**39.23**	**12.05**	**39.06**	**12.91**	**0.93**
5.	Staff involvement and training to sustain process	7.11	3.33	7.59	3.70	
6.	Staff attitude to sustaining the change	7.15	4.40	8.26	3.20	
7.	Senior leadership engagement	12.82	4.58	12.12	4.19	
8.	Clinical leadership engagement	12.15	4.60	11.08	5.14	
	Organisation	**11.81**	**4.41**	**13.41**	**3.98**	**0.02**
9.	Fits with organisation's strategic aims and culture	3.94	2.49	5.60	2.08	
10.	Infrastructure for sustainability	7.87	2.97	7.81	2.68	
Total mean score: Pre-intervention 75.21± SD 21.71 Post-intervention 76.81± SD21.45						

*p – value was determined by t -test

Table 7.5 shows the mean score for each knowledge item. Nurses' knowledge ranged from 75 to 140 with a total mean score of 121.45±SD16.85. An independent-samples t-test was conducted to compare before and after intervention total score, and found no significant differences, t (150) =1.32, *P*.189, with mean score of 124.84 ±SD14.66 pre-intervention and 121.45±SD16.85 post-intervention.

Table 7.5 Pre- and Post- intervention knowledge scores

Knowledge		*Pre- (n=75)* Mean (SD)	*Post- (n=77)* Mean (SD)
1.	Hand washing is important to prevent cross infection	9.57(1.23)	9.59(1.03)
2.	Alcoholic antiseptic solution is recommended over soap for hand washing	8.16(1.94)	8.07(1.99)
3.	Regular positioning of patients can help prevent VAP and pressure ulcers	8.21(1.91)	8.35(1.88)
4.	Elevation of head of bed more than 30 degree is recommended for all ventilated patients	9.13(1.30)	8.99(1.19)
5.	Chlorhexidine is recommended for oral care and disinfection in prevention of VAP and CRBSI	8.60(1.59)	8.53(1.56)
6.	Enteral nutrition should be started immediately for all ventilated patients with no contraindication.	9.33(1.18)	8.93(1.49)
7.	Maximal barrier precautions are recommended to prevent infections in ICU.	9.09 (1.20)	8.95(1.25)
8.	Early mobilization reduces ICU complications	8.80(1.05)	9.33(7.42)
9.	Subglottic suctioning can prevent microaspiration in ventilated patients.	8.19(1.84)	8.07(1.81)
10.	Blood or tracheal secretions culture and sensitivity is recommended if patient shows signs and symptoms of infection	9.25(0.89)	8.96(1.14)
11.	Exposure to evidence-based practice can help nurses prevent VAP, CRBSI and pressure ulcers	9.31(1.24)	8.99(1.25)
12.	Hygiene can help reduce infection for ICU patients	9.57(1.22)	9.23(1.22)
13.	Assessment of pressure area is indicated for all ICU patients	9.24(1.06)	8.92(1.22)
14.	Each patient shows specific signs and symptoms if he/she develops VAP and CRBSI	8.91(1.68)	8.47(1.74)
	Total mean score: Pre-intervention 124.84 SD 14.66 Post-intervention 121.45 SD 16.85		

*p – value was determined from T-test t (150) =1.32, P= .189

ICU -Intensive Care Unit
CRBSI-Catheter Related Blood Stream Infection
VAP-Ventilator-Associated Pneumonia

7.8 Discussion

Evidence-based guidelines help improve patient care although the implementation and sustainability of changes can be challenging, especially in a developing country. The organisational factors and cultural influences with potential impact on acceptability and sustainability of EBP need first to be identified. This study has described the challenges to sustainability for quality improvement in a Malaysian ICU, and focused on preventing three major ICU-related complications: VAP, CRBSI and PU.

The action research methodology used in this study was to drive clinical practice improvement and not to demonstrate causality. Therefore data trends should be considered in the context of measurement issues and absence of a definitive sample size to demonstrate effect. It is also important to consider the difference between statistical and clinical significance. A result can be clinically relevant but might be neglected if statistical significance was not attained due to small sample sizes and high intersubject variability.[5] The evaluation of clinical significance can provide more interesting results for health care clinicians as well as clients receiving care, facilitating the transfer of knowledge into clinical practice.[6] Moreover the use of data in this context is to provide an opportunity for reflection, benchmarking and orientating staff to the importance of measuring outcomes.

Findings from this study have demonstrated a reduction in the complications rate from 21 to 11 cases of VAP, CRBSI and PU in the pre and post intervention phases. In looking at the three complications separately there was an increased of VAP cases from four (pre-intervention) to five in the post intervention, no CRBSI was detected in the evaluation phase compared to one case in pre intervention. The PU rate fell from 16 to 6 cases in the post intervention period. The reduction of PU rates was statistically significance (χ^2=8.14, df=1, p=0.04).

In the context of the action research study it is important to consider contextual factors contributing to these changes. Firstly, in the study setting there is

a routine practice of an immediate removal of central venous line if there is any sign of infection, even though this may not have been confirmed by taking blood cultures from the central catheter lumen and peripheral line. This practice may have contributed to the lower rate of CRBSI documented in this ICU. (ICU Ward Manager, Personal communication, 5 March 2010) Secondly, in October 2010, the ICU was equipped with 10 new beds (Hill-Rom) which made positioning of patients easier. (ICU Ward Manager, Personal communications, 5 May 2011) This innovation may also have contributed to the reduction of PU rates from 16 to 6 cases in the evaluation phase.

Thirdly, during the evaluation phase, the ICU also started using a computerised hospital information system (HIS). Although, less paperwork was required except for documentation of the Waterlow pressure ulcer assessment, nursing care plan, daily treatment plan and medications, however the skills required to use this system became a competing demand with the change process. Fourthly, the reduction of the PU rate in the post intervention may have occurred from under documentation of PU because in the patient profiling approximately 87 (75.7%) of the 115 patient medical records in the post intervention follow up period were found not to have any Waterlow pressure ulcer assessment form. Only 25% of the 115 patients were partially screened using the Waterlow pressure ulcer risk assessment. At that time, the HIS was considered already 'fully implemented' in the ICU although some paper documents continued to be used, such as for patient daily treatment, nursing care and medication records. This finding may indicate that the nurses had overlooked documenting PU risk assessment in the Waterlow Pressure Ulcer form. Therefore they may have underestimated the number of PU occurred on the patients.

In summary, a definitive cause for a reduction in the PU rate from pre to post intervention was not able to be determined. Evaluation of the sustainability of practice for assessment of PU was also not able to be confirmed because during the evaluation period the HIS that was introduced during this period could have distracted from the implementation of the change that was recommended in this study. There was also a possibility PU assessment was conducted but was not

documented in the Waterlow Pressure Ulcer form. Furthermore, the requirement for reporting or documenting number of PU was still not a compulsory requirement. Therefore that might have caused nurses to underreport PU that occur in the unit to avoid the blaming mentality.

Nurses also have perceptions that time spent for documentation is generally not considered patient care.[7] According to Keenan and colleagues[7] nurses have overwhelmingly negative attitude toward formal recordkeeping—either outright hostility or the view that documentation is "just a requirement." This might explain why the Waterlow PU assessment was not completed in most patients. It is likely that no formal documentation was done but the focus on preventing pressure ulcers in the intervention may have had an effect in reducing PU. The PU reduction may also be able to be attributed to nurses having control of PU management.

The patient profiling found that four of the 10 patients who developed complications died in the ICU or ward. The patient severity of illness mean scores, SAP II and SOFA for the pre-intervention group with complications were 46.3±SD18.1 and 8.1±SD3.9, respectively. The scores were slightly lower for the post-intervention group at 45.0±SD15.2 and 7.0±SD2.5, respectively. The SAPS and SOFA score for patients with complications were collected in this study to ensure the pre and post intervention groups are similar. This indicated that were no major differences in pre and post patient groups and both groups that developed ICU complications had an equal chance for ICU complications. Based on the Charlson Comorbidity Score the pre-intervention cohort was sicker and older than the post–intervention group but the small sample size precludes making definitive comments.

The mean length of ICU stay was 12.2±SD7.1 days in the pre-intervention group and longer in the post- group (19.5±SD13.4 days). The length of ward stay was double in the post intervention group - 15.1±SD9.5 days *vs.* to 7.2±SD9.6 days in the pre-intervention group. The Malaysian Registry of Intensive Care reported mean stays of 4.1 and 4.3 days and mean hospital stays of 16.6 and 13.2 days in 2004 and 2009 in this ICU.[8] The national mean ICU stay was 4.7 days in 2004 and 4.4 days in 2009 and the average hospital stay 19.5 days in 2004 and 19.4 days in 2009.[8]

The increased lengths of ICU and ward stays were perhaps due to the large group of trauma patients in the post intervention group. The length of ICU stay was higher in the post intervention group which may indicate the patients' higher risk of developing ICU and hospital complications.

Interpretation of these data is challenging because different patients were admitted at different times and for different lengths of stay. Additional benchmarking and monitoring is required to identify the system, patient and provider factors predictive of adverse outcome. The increasing demands for health resources and staffing internationally has signalled the urgency of addressing these factors to ensure the health and safety of consumers.

The majority of nurses had a high positive regard for their professional practice environment with a mean score of >3 (out of a possible four) for *Internal Work Motivation*, *Staff Relationship With Physicians* and *Cultural Sensitivity*. However, *Handling Disagreement And Conflict*, *Leadership And Autonomy In Clinical Practice*, *Control Over Practice*, *Teamwork* and *Communication About Patients* scored lower. The mean score for each component was similar for pre- and post-intervention. This result was comparable to that in Charalambous et al's[9] study in 13 different wards in three acute hospitals in Finland in which the participants also responded differently on their professional practice environment. The mean responses for 5 of 8 subscales were > 3 and the remaining 3 subscales scores 2.39 (*Control Over Practice*) 2.85 (*Teamwork)* and 2.72 *(Handling Disagreement and Conflict*).[9] Another study undertaken in the US Massachusetts General Hospital found a more positive practice environment perceived by their nurses.[10] The nurses reported mean scores were equal or higher than 3 for 6 of the 8 subscales. Two subscales that were less than 3 were *Handling Conflict* (2.7) and *Teamwork* (2.9). The professional practice environment can be very different for different nurses. Findings from pre- and post- intervention group indicated that there is no improvement in the nurses practice environment during this period of time. There was obviously a gap relating to the nurses' work environment between the international and current studies.

A healthy work environment is important for nurses to meet their organizational objectives and achieve personal satisfaction in their work.[11, 12] In this study, the mean scores for *Control Over Practice, Internal Work Motivation* and *Staff Relationship With Physician* were lowered than pre-intervention group. Mean score for *Leadership and Autonomy in Clinical Practice* was not changed for pre and post intervention groups.

The lack of control over practice in both time period could be related to the bureaucratic environment which limited decision making at the nursing level as hierarchical authority is practiced and cultural factors in Malaysia. This finding is similar to that from a study[13] on variation in the nursing practice environment in Magnet and non Magnet hospitals. The authors found that a bureaucratic environment is one of the factors causing nurses to feel that they lack control over their practice instead of facilitating centralised decision making. In this study nurses reported that they had lack of control over their practice.

The lack of autonomy in clinical practice among nurses may be related to an historical emphasis on dependent nursing practice and a hierarchical organisation of the delivery of health care.[14] The lower mean scores in post intervention group for *Staff Relationship with Physician* and *Internal Work Motivation* also can be contributed by lack of control over practice. A growing body of literature supports the finding that lack of control, and therefore, lack of autonomy, can negatively influence the provision of quality care to patients.[15, 16] This finding is important to be considered by managers, policy makers and health-care service providers. Ulrich et al.[17] also indicated that to establish healthy work environments, leadership is critical at every level of nursing because it will create a vision and provide inspiration to transform the vision into reality. Feedback from the professional practice environment can serve as effective information that can help a nursing leader improve the various components in the department.[18] The frontline managers are critical to the success of every organization because of their understanding of both the organization's vision and its social structure as this will facilitate them to serve as interpreters across organizational levels and interdisciplinary groups.[17]

Evaluation of the likelihood of sustainability of clinical practice showed positive attitudes toward the change process. The mean Sustainability Indices for pre- and post-intervention were 75.21±SD 21.71 and 76.81± SD21.45, respectively, which are good scores for sustainability.[19] Furthermore with more than 92% response rate in both groups are adequate to establish if there is difference between the population.[20] Although total mean sustainability scores shown chances of successful sustainability. However, the score achieved in the *Staff* subscales all factors requires more attention. The factors are *Staff Involvement and Training,* and *Staff Attitude* in sustaining change. Some staff may not been involved at the beginning and possibility not all staff may be aware about the change strategies proposed because of the high number of staff in the unit. This needs to be addressed in future study. Another two *Staff* subscales the *Clinical and Senior Leaders' Engagement* were the factors have the biggest improvement gain if they promote the change from the early stage.[19] This is the factor that needs to focus on in future study.

Despite the low number of PU detected, minimal improvement was noted in documentation of the Waterlow risk assessment to assess pressure area risk. Out of 115 patient medical records observed, 75% did not have any documentation on the assessment which, presumably, was not done. In other words, while professing the belief in change, little evidence of this was available via documentation. This finding was similar to that in another study in Malaysia of discrepancies in oral care practice for patient between self-reporting and independent observation.[21] In this study, the nurses claimed to be using toothbrushes for oral care on mechanically ventilated patients, but none was actually observed to be doing so. Such false but *proper* response can be attributed to cultural values[22] as Asians tend to be modest and highly desirous of responding to please.[23, 24]

The mean scores for the individual knowledge items were > 8, indicating good knowledge on infection prevention. The knowledge on *infection control prevention* was not significantly different between the pre- and post-intervention groups. This result can be attributed to infection control measures, such as hand washing, standard precautions, central venous care bundles, ventilator care bundles,

being normally emphasised in ICUs all over the country so that it is fairly common knowledge.[25-27] Protocol for ICU patient care is also included in the ICU management protocol.[25, 27, 28] As all the prevention strategies were common knowledge for nurses, they were able to portray good knowledge. However, it was found that the knowledge did not necessarily translate to good practice.[21] A study in Malaysia evaluating medical doctors and allied health staff, including nurses, on their perception of EBP found that in allied health staff, 61% of 52 agreed that "the importance of EBP in patient care is exaggerated", and 46.2% that "EBP is too tedious and impractical".[29] In contrast, in a Western country, the majority of nurses professed a lack of knowledge in VAP prevention strategies but, nevertheless, were observed undertaking the tasks.[30]

This study has provided information for future quality improvement projects in this setting. The results indicate the need for continuous monitoring and supervising with involvement and support by all levels of medical and nursing administration throughout the process of change. Nurses are usually hard pressed for time, so tend to only concentrate on their routine and technical work such as regular nursing care, or drug infusion techniques.[31]

7.9 Limitations

The limitations of this pretest-posttest method of evaluation are noted. There is potential of Hawthorne effect during the pre-test because the researcher was more regular visits at the unit and this was further limited by lack of blinded assessment on their nursing care practice especially on the compliance to the EBP as proposed in the study in pre and post test groups.

This study has implemented the seeds of practice improvement in this setting. A few challenges of implementation were identified during this study. Firstly, competing demands occurred in the organisation with the change process such as implementation of HIS during the post intervention. Secondly, this unit has a bigger group of nurses therefore it was difficult to ensure that all the nurses were aware of

the intervention strategies. There was a high possibility that ineffective uptake of prevention strategies occurred because not all nurses were aware of the prevention strategies suggested in this study. Thirdly, the need to have medical officer involvement in diagnosis of VAP and CRBSI, and routine removal of central line with signs of infection without sending any blood culture investigation may have underestimate the number of CRBSI occurred. Therefore, the small sample size of patients with complications (VAP / CRBSI) did not allow measurement of improvement. Finally, approximately 75% of patient's record did not have any documentation on the pressure assessment being done which indicated that very little change was actually adopted in the change process in respect of documentation.

Despite these limitations, the study has provided important baseline information for future quality improvement initiatives and an important insight to driving change in clinical practice particularly within the context of developing countries. Some authors have urged that research findings need to be reported in language that is familiar to practitioners.[5, 6] With the introduction of EBP and advancement of health care researchers need to provide information regarding their research that can be used in clinical practice and demonstrate an impact in health care and clinical decisions.[5] The information of "p" values is insufficient to achieve these requirements and because it provides insufficient and limited information, clinical researchers needed to present the clinical relevance of their results to help busy clinicians with interpretation.[5]

7.10 Conclusions

In conclusion, using an action research model, this study has demonstrated a decrease in PU complications in the ICU. Even though it was not possible to attribute it to the changes introduced, because of other concurrent changes being undertaken in the ICU and the study design. Methodological considerations preclude demonstration of causality but in the context of prevention of PU the trends shown was encouraging. This can be due to improvements in reducing VAP and CRBSI during the study. Therefore, implementation of PU assessment and management has

compliment the prevention of the three common ICU complications. There was no substantial difference between the pre- and post-intervention groups based on the ICU patient severity of illness scoring systems (SAP II and SOFA). Only a slight difference in diagnostic category with trauma patients featuring much more in the post intervention review period.

The success of action research should not be judged only on the change achieved or the direct impact of solutions. However, it should also be viewed against what was learnt from feedback to formulate future policies and recommendations.[32]

Preventing complications in the ICU is challenging requiring innovative, tailored and targeted approaches. Although in this study the nurses stated a commitment to improve patient outcomes, some lacked awareness of the importance of implementing EBPs in their daily work and the power of research to improve outcomes. Despite their apparent knowledge this was not necessarily translated to practice. Given the importance of the hierarchical organisational structure, engaging executive, interdisciplinary support is critical to drive practice change.

On reflection of the pre and post-intervention groups finding, nurses had portrayed good knowledge on infection prevention and the number of PU rates was reduced but there was limited evident of documentation in the Waterlow pressure ulcer assessment form. The next step of the action research cycles is to explore problems encountered by nurses during the sustainability of the change process.

This chapter had provided the comparison between pre and post interventions in the Phase One and Three. The next chapter will report more in depth issues related to implementation and sustainability of EBP among the ICU nurses.

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CHAPTER 8

PHASE 3: SUSTAINABILITY OF EVIDENCE-BASED PRACTICE

CHAPTER 8
PHASE 3: SUSTAINABILITY OF EVIDENCE-BASED PRACTICE

8.1 Introduction

Chapter 7 has provided the findings of the pre and post intervention findings of ventilator-associated pneumonia (VAP), catheter related blood stream infection (CRBSI), and pressure ulcer (PU), assessment and prevention in intensive care unit (ICU). This chapter provides a more in-depth understanding on the challenges associated with sustaining of evidence-based practice (EBP) among nurses in Phase 3.

8.2 Aim

This study sought to assess the problems encountered by nurses in sustainably implementing EBP to prevent ICU complications in a Malaysian ICU. This phase 3 the following questions were addressed:

1. What were the nursing staff experiences in terms of practice change in the assessment process for VAP, CRBSI, and PU over the past 12 months?

2. What challenges did nurses meet during implementation and maintenance of the change process?

3. What were the facilitators for implementing and sustaining change in the ICU?

8.3 Methods

8.3.1 Design

A qualitative approach was undertaken in the post-intervention phase to ascertain participants' experiences and perspectives of change adopted in the ICU. This method of data collection is useful because it obtains a range of views, some not even anticipated by the researcher.[1] Focus groups were undertaken to discuss the barriers and facilitators to change in preventing VAP, CRBSI and PU. Further detailed are described in Chapter 4.

8.3.2 Setting and participants

The study was conducted in May 2011 in a 17-bed ICU medical surgical ICU, in the only public critical care referral centre at a Ministry of Health hospital in the East Coast of Peninsular Malaysia. All nurses working the day shifts were invited to participate in the study and allotted to one of five focus groups. The rationale of having the groups was explained to the potential participants and they were advised that participation was voluntary. Further details on the study setting and participant characteristics are provided in Chapter 4.

8.3.3 Data collection

The group discussions were used to obtain the participants' views on maintaining the VAP, CRBSI and PU assessment tools in their daily practice and their views on the practice change intervention. The discussions lasted approximately 30 to 40 minutes. The discussions were conducted in Bahasa Malaysia by the researcher who has a critical care background and who was a former nurse in the ICU. The topics included the nurses' perception of change in assessment tools over the previous 12 months, barriers and facilitators to sustaining the change, experiences using the tools, and suggestions on how the change should be introduced, implemented and sustained in the future. Further details on data collection are described in Chapter 4.

8.4. Data coding and analysis

After the discussions data were transcribed and each participant was requested to review their group transcript to ensure accuracy of the proceedings. Preliminary analysis included multiple readings of the transcripts and note taking. Further details of data analysis and coding are provided in Chapter 4.

8.5 Findings

Five focus groups were formed, consisting of two to six participants. The participant characteristics are presented in Table 8.1. The main reasons provided for nurses not participating in group discussions were that the nurses were too busy. Three overarching themes emerged from analyses of the discussions on practice change experience and associated factors: 1) empowering staff to embrace EBPs, 2) staff knowledge, attitudes and beliefs impact on maintenance of practice change, and 3) workplace culture/need for management-driven change to influence staff behaviour change. Excerpts from the group discussions are presented in Table 8.2.

Table 8.1 Focus group participant characteristics

Characteristic (n=19)	n	%	Mean (SD)	Range
Age (Years)			32.47(4.91)	26 to 48
Length of service as registered nurse (Years)			9.05(4.30)	4 months to 21
Length of service in ICU (Years)			5.33 (5.02)	1 month to 20
First nursing qualification				
3-year certificate	2	10.5		
3-year diploma	17	89.5		
Highest nursing qualification				
3-year diploma	9	7.4		
Post-basic critical care	7	36.8		
Post-basic infection control	1	10.5		
Bachelor degree	2	5.3		

ICU- Intensive Care Unit

Table 8.2 Themes and quotations from the focus groups

Themes	Subthemes	Illustrative quotes
Empowering staff to embrace evidence-based practices	**Recognising pressure ulcer and taking action**	Nurse without any post basic critical care nursing qualification like me did not have any advancement in nursing…after we learned to assess for pressure ulcer we get the knowledge because we had been practicing the assessment….before this we did not able to recognized the first degree pressure ulcer. Now we can recognized and take the action immediately before it became worse. [Interview 4: 30, 42, 95]
	Embedding change	You already give us one year time to practice. Earlier we felt difficult but now we felt like it (Waterlow assessment) is already inside us (doing well) we know what is in the assessment. Even we did not do (fill in the Waterlow form) the Waterlow. We know the patient is at risk such as age, skin type. Only we did not write down, no documentation. If we found patient with pressure sore we directly document in the report (nurse report) and do positioning. [Interview 1: 22, 28, 32, 50]
	Improving practice	Yes, there is improvement such as mouth toilet, hand washing for staff and visitors are improving a lot. Head of bed elevation we always remember to prop up the patients even without using the stick that you have provide to us. [Interview 4: 26, 219, 227, 231]
	Ongoing guidance	We need somebody that can guide us. When you are not around, The ward manager can take over. But sometimes if the ward manager not around who can we ask? [Interview 4:148] Waterlow pressure ulcer is good. Need to be continued but need to be included in HIS (hospital information system). If still used paper it might be drop outs. If compulsory to do it we will do. I think if sister (ward manager) ask to do, they will also do it (nurse who refused to do Waterlow assessment). [Interview 2: 71, 82, 93, 94]

Staff knowledge, attitudes and beliefs that impact on behaviour	**Lack of knowledge and training capacity** **i. Information Technology system**	When we started last year it is much better. (Implementation of Waterlow pressure ulcer assessment) This year when we start to implement the hospital information system everything were spoiled again, just like the beginning before you came. [Interview 3: 30,31] Too busy with paperless. After we start using hospital information system in one to two month. We felt very headache using the computer. [Interview 5: 13] Everything need to be covered from the observation chart, it sure take time for them and they don't know how to use computer possibly because they have never touch computer before but still they have no choice they still need to use. [Interview 3: 82, 85]
	ii. Clinical knowledge	From my understanding these nurses perceived that when the skin is tear they identify it as bed sore. [Interview 3: 51] Some are still arguing with us, there was one child has a small redness on his skin. When we check their nursing care plan / nursing note no bed sore written. I'm not sure how they do their work. [Interview3: 164]
	Attitude toward documentations of PU assessment	Maybe nurses do not document (Waterlow assessment) because they feel it like superfluous. I think laziness is the main reason of not doing it. [Interview 1: 53, 59]

	Ambivalence and resistance to change	...Waterlow, that is a new thing, but for her that is not a compulsory thing, she says oh this thing, (Waterlow pressure ulcer assessment) somebody wants to learn to do research. For her that thing is not important and not compulsory. [Interview 3: 145] I mean like "ketuk paku dengan penukul" (Tap the nail with the hammer) not all nurses like that. Some of them but not many I also praise them because they know their work... [Interview 3: 127] I can feel that since we as the supervisor here, many of these nurses need to be forced to do everything. Out from themselves they will not do it, like they are not sincere. We can count the number of nurses that can do their work properly. That mean she can do it herself without force. When there is new change implementation even the intensivist had commented. They think that they have study 3 years in basic nursing already adequate. Sometimes I also feel very annoy with the nurses here. [Interview3: 113]
	Beliefs regarding hierarchical status/positioning	My staff like to listen to the doctor...She think that she work under doctor even bedsore she expect doctor to check. Which one is doctor or nurse's job she also doesn't know how to differentiate. [Interview 3: 140]
	Staff motivation (to persevere with systematic data collection)	When the change take longer time people became bored. That why if you see in one, two, or three months people get excited but after six month getting slower because people already know. [Interview 1: 67]

Workplace culture: need for management-driven change to influence staff behaviour change	**Standardised practices must be enforced by supervisors**	I think factor that can help is the boss also helps to make the change successful, give the staff cooperation with the change. The boss needs to say and emphasis that the change needs to be done. [Interview 2: 142, 146]
	Consensus/unification regarding change. (Without consistent management//supervisor support and leadership, staff didn't engage/enact the change)	After we apply the hospital information system I'm just back from long sick leave. I admit that I did not monitor the progress of Waterlow implementation. Because I saw things look much better than before we implement the assessment, but apparently after we start the hospital information system they forget about the Waterlow assessment. [Interview 3 : 65] ...Even we know the pressure ulcer assessment is important for our patients care. But only we alone doing it and other people say no and the boss also did not emphasize that why some is doing it and some is not. [interview 2: 152]

8.5.1 Empowering staff to embrace evidence-based practices

Overall, participants provided positive feedback on the change process. One said that she had learnt much and improved her assessment skills particularly for PU. They also said that the practice of hand washing, mouth care and elevation of head of the bed had improved considerably during the course of the programme.

Although many admitted that they did not use the specific assessment forms, they applied this systematic process to their assessment and communicated this to their peers. They claimed that they already knew about the specific information in Waterlow assessment even without using the specific assessment form. They did not document PU assessment on the form but in their nursing report. They suggested incorporating the Waterlow assessment form in the hospital information system so that it forms part of the routine nursing assessment and is easier for all nurses to complete. But the decision for this to occur must come from the nurse manager in order to firmly embed this practice.

8.5.2 Staff knowledge, attitudes, and beliefs that impact on behaviour

The nurses described the knowledge, attitudes and beliefs of staff impacting on undertaking and maintaining assessment tools with patients and modifying their practice. They described aspects of a competing change initiative involving the information technology (IT) system which inhibited maintaining changed assessment practices. Their clinical judgements and knowledge of ulcer staging were also considered to impact on their assessment practices because some nurses have perception that stage two PU or above only reported as PU

During the period of the change process, a new IT system was introduced. Competing demands in an already busy working environment created conflict. The nurses lacked knowledge and skilled in the use of the IT system. A barrier to implementing the change that they identified was implementation of the *hospital information system* (HIS) which caused them to neglect the assessment of PU as they had a hard time learning the computer skills. One nurse said that a change of

practice was taking place before the hospital implemented its (HIS). After the HIS was started, the nurses focussed so much on using the system that the changed practice lapsed.

Issues in clinical knowledge were also evident from the discussion. It was apparent that some nurses lacked knowledge about PU staging and had different ideas on staging PUs. Only skin break down, as in Stage 2 or above PU - as defined by the National Pressure Ulcer Advisory Panel[2] – were considered by some nurses to be a PU. Therefore, Stage 1 PU would have been missed.

The nurses felt a need for continual reinforcement of preferable practices the work in the unit as counselled by the proverb: *Tap the nail with a hammer*, which means that to make things happen, someone must continuously apply pressure, otherwise the work will grind to a halt.

Beliefs in the hierarchical status / positioning of nurses and doctors were revealed in the interviews. One nurse said that nurses think they were only handmaidens to the doctors; therefore, the doctors should assess for PU. They could not differentiate between their and the doctors' responsibility, which may resulted in overlooking the PU assessment.

A common problem encountered was resistance to change and varying levels of acceptance to change among the individual nurses. This project was not prioritised by the ward staff in spite of the use of action research framework and attempts to engage ownership. The nurses' perception of the priority of the intended practice change was not always apparent due to the feeling that it is someone else's work and does not concern them. The motivation to collect data was reduced because of the perception that this was 'research' reflecting a reticence to internalise these practice change.

8.5.3 Workplace culture: Need for management-driven change to influence staff behaviour change

Participants also said that the lack of management support during the change process - monitoring, checking progress of the change process – may add to the chances of failure of the change implemented. A nurse also said that in order to make change happen in the unit, the management must always emphasise the change. For example, the nurses knew that assessment of PU was important but if not emphasised by the management, the change will not be successful.

8.6 Discussion

The growing pressure to reduce healthcare-associated complications which have major economic and clinical impacts[3-5] has moved health care providers to review their practice to provide improved patient care.[6, 7] This study has been undertaken to measure the success of changes made in adopting EBP and to evaluate their effectiveness in reducing the patient infection rate.[8-10] The Center of Disease Control and Prevention (CDC) has also recommended a set of evidence-based recommendations which also address nursing practice.[11] This cycle of the action research study focused on identifying the problems related to implementing and sustaining nursing practice change in assessing for VAP, CRBSI and PU in a Malaysia ICU and infection prevention.

The focus group discussions suggested the barriers and facilitators to sustaining change in this unit. Important barriers identified included the nurses' knowledge, attitude and beliefs that impact on behaviour. The nurses lacked knowledge on staging PUs and on the IT system recently implemented in the ICU. Moreover, embedded hierarchical structures impeded autonomous engagement as well as a reliance on the supervisor's direction.

A lack of knowledge is also associated with a lack of initiative that creates ambivalence and resistance to change. Birks et al.[12] used the S.J. Robert[13] five-stage

model (process of nurses rising above oppression) to illustrate how Malaysian nurses stand in the model. They placed Malaysian nurses in the first stage - *unexamined acceptance* - which means acceptance of the status quo and their role in the organisational status.

Responses of nurses reflected their comfort with the current practice. In their discussions, some felt that their 3-year nursing diplomas were sufficient in making them *excellent nurses*. Therefore, they were reluctant to change, thinking that they were already providing the *best* care to their patients. With the current evolving health care system the ways in which nurses were educated in the 20th century are no longer adequate for dealing with the realities of health care in the 21st century.[14] As the care environment and patient needs become more complex nurses need competencies requisite such as leadership, research, EBP, teamwork and collaboration to deliver high quality care to patients.[14, 15] In order for nurses to fill in the expanding roles and to master technological tools, information management system while collaborating and coordinating care across team of health care professionals they need to be better prepared through education.[14]

Nurses did not appear to appreciate how research could leverage practice change and improve health outcomes. They perceived any change proposed as part of other people's study or others doing research, and not to be part of their routine practice. Nurses with such perception will place low priority on research which they just assume to be other people's work. This was reflected in their not doing the Waterlow PU assessment because they considered it for other people's study, that they already tacitly carried out a PU assessment anyway and it was not placed in their routine work.

Another point from the focus group discussions is that the nurses lost interest in the data collection due to the duration of the project. They considered that they had gleaned important information, embedded this in their practice and the process of documentation was tiresome.

Despite the importance of research for professional development,[16, 17] in this workplace focus group data revealed that nurses did not always place a high value in research in improving patient care. This could be due to the fact that the majority of the nurses were only diploma holders with only five (5.7%) having a degree, and therefore having less knowledge and awareness of research in improving clinical practice. In Malaysia, the nursing discipline is still professionally in its infancy.[18] Having a degree is still not the minimum requirement for registered nurse.[18] Although exposed to the basic concepts of research at the diploma level, many nurses in Malaysia still have poor access to computer facilities and are isolated from expert support, denying them the opportunity to see the relevance of research to practice. Moreover, the fact that most research is published in English makes it difficult for those whose first language is not English.[19] Patient care continues to grow more complex with nurses having to make critical decision, use of more sophisticated life saving technology and information management system that require skills in analysis and synthesis.[15] A more educated nursing workforce is require to fulfill the requirement of evolving health care demand.[15]

During phase 3 the HIS was started (in January 2011), and many nurses had difficulty in learning the system, and placed less emphasis on the Waterlow PU assessment. Although the data collection was still done, paper documentation was used, such as for patient medication, daily treatment chart, and nursing care plan. The purpose of using technology is to increase the quality of patient care.[20] It would be expected that when the IT system was implemented nurses spent less time for charting and more time for patients care.[20] A study on implementation of a clinical information system in an ICU found that patient care took 81.1% of the total nurses' working time in 2000 (pre IT system) and 86.6% in 2002 (post IT system).[21] The time used to document the nursing care increased but not significant by 3.6% ($P>0.05$), or 15 minutes after implementation of the clinical information system. Perhaps in this study nurses need more time learning the system because introducing a HIS in this setting has represent a major change in practice which is distracting, time consuming and might displace other nursing care activities.

Educating nurses is important because the knowledge gained provides the basis for greater awareness. According to Mathai,[22] awareness is necessary to help nurses understand their capacity to contribute to preventing hospital-acquired infections through effective and sustained behaviour change.[22] Knowledge also influences behaviour directly and is essential for the individual to evaluate any threats faced, and to understand that a given behaviour can counteract or increase the threat(s).[22] A study on 168 of the 210 adult acute care general hospitals in Pennsylvania found that every 10% increase in the proportion of nurses holding a bachelor degree was associated with a 5% decreased the risk of mortality and failure to rescue.[23] This finding has proved that hospital employment of nurses with bachelor degree and higher degrees is associated with improved patients outcomes.[23]

Nurses said there was still a problem with nurse / doctor relationships. The power relationship between doctors and nurses were well documented and frequently results in difficult team work, partly because the professions are not considered equal within the health.[24, 25] Internationally, many studies have reported the relationship impacts on the change process [26-28] but there have been limited studies in Malaysia. One found that Malaysian nurses face lack of recognition, unfavourable conditions of employment and gender inequality.[12] It is widely understood that the nurse-physician relationship can impact on patient care.[26, 27] The quality of patient care delivered is highly dependent on the workplace environment – whether there is a good / bad working relationship between the doctors and nurses.[25] Therefore, implementing supporting collaborative work strategies will help foster collegial work practices and communication.

The third theme identified was a lack of management support for change, such as lack of monitoring and checking of the progress of change, lack of cooperation and support from the management and lack of emphasis on the change requirement by the medical team. A survey found that the nurses had to feel supported and mentored by their leadership throughout the research utilization process.[29] They identified the lack of support and mentoring as the top three barriers to the use of research findings in practice. Cooperative work helps nurses to engage in effective conflict management strategies and, ultimately, their units' ability to

work effectively.[30] A supportive culture emphasizing team work with high standards is more likely to perform better than one emphasizing competitiveness or concerned with how well people fit in.[31] This is due to high pressure for work performance which would require considerable coordination and communication across a wide range of caregivers.[32] According to Shortell,[32] a team-satisfied culture that emphasizes self-expression, achievement, cooperation, and staff development is most likely to be associated with better unit performance.

Despite the barriers to change in practice found in this study, some of the nurses were optimistic that at least some change had taken place, positively improving their knowledge on assessment of patients and some of their common practices in the ICU. The barrier they were currently facing was the implementation of HIS as most of them were not knowledgeable in IT. The HIS implementation had increased the nurses' workload due to their inadequate computer skills. It could be argued that challenges in implementing changes was because of the competing issues of the new IT system may have interfered with the change in care practices.

8.7 Recommendations

These data have identified some salient issues of the project, the nursing profession and change management strategies.

8.7.1 The project

In spite of striving to adopt an action research project, it was apparent that engaging leadership support as part of this project was not as successful that it could have been. A potential explanation can be that there was a mismatch between the collaborative and empowering model of action research and existing practice patterns. Another possible reason is embedded in the Malaysian cultural context such as hierarchical structure,[33] maintaining balance[34] and respecting the elder / senior[35] in the nursing team. In order to maintain balance in the nursing workforce other junior nurse managers are concerned that their engagement in the change

process will creates conflict in their relationships[36] with the ward manager in charge who is not very supportive to the change proposed. Therefore they were not able to fully commit because of respecting the senior leadership and also showing their mutual respect.[37] In spite that they realized the importance of the change process to improve patient care. The unsupportive roles by the nurse manager in charge have created a great barrier for implementation of the change process proposed in the INVEST study.

There are few recommendations for future study arises from this study finding. 1. There is a need to have multidisciplinary engagement in the change process. Without full commitment from the leadership, the change will less likely to be sustained. 2. Continuous monitoring of EBP implementation at the hospital level is crucial with active involvement of senior and clinical leaders to reinforce and guidance in each setting from the beginning to embracing EBP. 3. Provide regular feedback to the staff on the success of interventions to motivate them to continue with the change process. 4. Plan EBP continuous nursing education (CNE) for all nurses working in the country. 5. Collaboration between the nursing educators, nurses, administrators, researchers and policy makers is needed for successful implementation of EBP in the ICU. These include increasing the entry requirement for nursing profession to a bachelor degree. Enforce implementation of EBP at all nursing institutions and hospitals.

8.7.2 Nursing profession

There is a need to address the nurses' knowledge and attitudes towards change. Improving nurses' knowledge is important for more nurses to undertaken the advance practice nursing roles. The advance roles will increase the nurse' competencies at a higher level demonstrating mastery in care management and decision-making at different clinical situations across all care settings.[38] The main benefits of highly educated nurses in the workforce are the potential for improving patient outcomes.[15, 23, 39]

8.7.3 Change management

These data underscore the importance of considering cultural factors, both organisational and societal in quality improvement initiatives. The pervasiveness of hierarchical organisational structures is important to consider. A risk management system acknowledging competing demands in dynamic, real world environments is important to consider. A study evaluating the support to nurses to continue involvement in quality improvement showed that most reported motives for remaining active in quality improvement were the opportunities for enhancing knowledge, influencing clinical practice, and developing as a nurse.[40] Thus, this strategy can be use as one method to increase nurses' involvement in the change process in the health care system.

8.8 Limitations

The sampling method for data indicates that the findings from this study cannot be extrapolated to other ICUs, particularly the fact that purposive sampling was used. Further, due to hierarchical workplace culture, the participants may not have expressed unpopular views to avoid cultural or peer pressure. Nonetheless, this finding provides information that can be used to assist future quality improvement initiatives in ICU signals important information for quality improvement initiatives in developing nations.

8.9 Conclusions

This study has described the experience faced by Malaysian ICU nurses in the implementation of a practice change process. They found that the change process was a useful learning experience for integrating EBP in their patient care. Some of the nurses considered that the research was protracted and therefore they were bored because they had extracted important and relevant information from the research. They found that the competing demands in the organisation cause role overload and

burden. They also indicated that some nurses were still resistant to the change even the change was implemented for longer period (12 months). They suggested embedding assessment items into existing information systems to assist in reducing barriers, improve compliance and sustain practice change. In addition, continuous monitoring, reinforcing, emphasising and engagement by the clinical leaders and supervisors were recognised as being necessary for embedding practice change.

This study has demonstrated the need to improve the nurses' knowledge, attitude and awareness of the importance of assessment and documentation for VAP, CRBSI and PUs in the ICU. Implementation of new knowledge requires a comprehensive change in behaviour by individuals working in complex organizations. In this study, participants described that the sustainability of quality improvement was dependent on supportive leadership, facilitative human resources, the need to increase knowledge including doing more research and enhanced implementation of research findings in clinical practice. These findings emphasise the importance of including both individual and organizational factors in strategic planning for practice change and quality improvement. The quality improvement plans must be long-range and take into consideration that adequate knowledge and skills, the potential for other intervening practices or projects, as well as a supportive context, are necessary for achieving sustainability in improving clinical practice.

This study will help future managers, researchers and policy makers understand the nature of the terrain so that they can find their way through the complex, iterative and organic process of translating EBP. In this study, ICU nurses were found to work in a high pressure environment, and were subject to a hierarchical structure where autonomy and independent practice were not fostered. These factors need first to be addressed before implementing clinical practice change.

This chapter had provided more in-depth issues on implementation and sustainability of EBP in an ICU by its nurses. The next chapter will summarise the findings of the thesis, discussing their implications on policy, practice research and education.

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CHAPTER 9

CONCLUSION

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9.1 Introduction

This thesis has used an action research approach to drive clinical practice improvement and obtain a greater understanding of the barriers and facilitators to improving outcomes for patients in the intensive care unit (ICU) and the sustainability of change management strategies. The conceptual underpinnings of action research were to inform the study design and intervention. The findings of the three study phases have been reported in Chapters 5 to 8. These phases have corresponded to the planning, acting, observing and reflecting cycles of the action research process. This chapter summarises key findings addressing each of the study aims and the implications for nursing practice, education, research and policy in a Malaysian context.

9.2 Assessing the findings against the study objectives

The aims of this study were to identify best practices, evaluate the current nursing practice in prevention of ventilator-associated pneumonia (VAP), catheter related blood stream infection (CRBSI), and pressure ulcer (PU) in ICU patients, and evaluate the effectivenes of evidence-based interventions to improve patient outcomes. The research objectives were to:

1. Identify best practice interventions for preventing VAP, CRBSI and PU in the ICU.

2. Document the current rates of VAP, CRBSI and PU in a single Malaysian ICU.

3. Implement an action research intervention to collaboratively develop and implement strategies for improvement.

4. Assess the impact of the intervention on clinical outcomes, staff dynamics, work place culture and sustainability of practice change

9.3 Key findings

Quality improvement processes are common in many ICUs,[1] however prospective and systematic action research studies are less well documented.[2] The majority of action research reports are not on the full cycle of the research conducted, but focussed on the process(es) of quality improvement and not the outcome(s).[2] This study reports a full cycle in-action research on implementing changes and evaluating the patient outcomes.

The process of developing and investing the INVEST Study has provided valuable information and identified key resources for preventing VAP, PUs and CRBSI in the ICU. There was no difference in the rate of pre and post intervention in the VAP and CRBSI complications. However, there was reduction in the number of PU complication. The reduction of PU achieved statistically significant, even though it was not possible to attribute it to the changes introduced, because of other concurrent changes being undertaken in the ICU at the same time and methodological considerations. Although the study design for the INVEST Study, cannot demonstrate causation, these trends are encouraging. Based on the ICU patient severity of illness scoring systems (SAP II and SOFA) there was no appreciable difference between the pre- and post-intervention groups.

The success of action research should not be judged solely on the change achieved or the immediate impact of solutions. Instead, it should also be viewed against what was learnt from feedback in introducing the changes for formulating future policies and recommendations.[3]

This study was over 10 months, sufficiently long for the action research process However during this period there were numerous contemporaneous factors which influenced the research process such as the type of patients admitted, modernity of equipment in the ICU, and concurrent changes being introduced in the hospital such as the hospital information system (HIS). In conclusion, whether there was a real improvement in patient care due to the interventions made could not be determined.

The INVEST Study failed to show demonstrable objective improvements across all areas of nursing practice but moved practices in the right direction. Although in the Western world the strength of action research methodology to drive organisational change in the clinical practice is well known. However, adopting action research in this ICU setting was not as successful in shifting improvements in all clinical indicators but did leverage some improvements and evidence of insight and culture change. The success of projects conducted outside of Malaysia is heavily dependent on a large majority of staff accepting and supporting the change agenda which was not always the case in the study site. The entrenched and embedded hierarchical practice structure, limited the capacity to ensure that nurses felt responsible for changing their practice.

There are few factors influencing the success of the study including nurses' knowledge, attitude and belief about EBP. In addition to the factors listed previously the main factor identified contributes to the failure in the study to uptake EBP are the cultural influences including the hierarchical structure in the organisation.

Hierarchy in the workplace as well as embedded traditions and cultural issues in nursing has created barriers for implementing changes. Workers in hierarchical organisation often have a group orientation, respect elders, seniority and hierarchy, emphasize loyalty and consensus and are concerned with harmony in relationships.[4] The responsibility for making decisions is given to management and not team oriented.[5] The leader accepts responsibility for the development and well-being of the employees, and in return expects their obedience and personal loyalty.[6]

In a hierarchical structure society the workers are more cautious in expressing their thoughts in order to maintain the balance within relationships. Disagreement, if expressed, will often be undertaken indirectly to avoid overt confrontation and arousing discomfort in other people.[4] This explains why in a high hierarchical structure workplace people are more inclined to state what should be said rather than what they really feel. This is in contrast to the Western preference to "say what is felt". In order to keep balance, work in harmony and also keep their jobs, the majority choose silence instead of unveil their latent talents or creativity. As a result, the workers in this country are less empowered *vis-à-vis* their Western compatriots.

In this study other junior nurse managers and nurses were concerned about fully engaging in the change process because the leader (nurse manager in charge) was not always very supportive to the change practice although initially she agreed to support the study. Although nurses knew the change is important to patient care however they were not fully able to embrace this as a consequence of showing their respect to the nursing leader *preference* as well as maintaining the balances relationship and to avoid conflicts in the group. Conflicts usually occurs when someone does not understand the clash between cultures caused by the differences between individualist values, collective values, power relationships, and feelings of certainty / uncertainty.[7]

The researcher was aware about this issue and she tried to overcome this problem by encouraging and empowering the nurses to engage in the change process. Nurses were also advised on the opportunity for the career advancement therefore engaging in the change process will be their initial move to prepare for career advancement especially in nursing research. The researcher also approached the nurse managers and explained to them the purpose of the study and also offered support to the unit. In spite of the initiatives that was undertaken to empower the nurses and to reduce the hierarchical differences among the staff however it was not fully successful because researcher is still consider as *outsider*.

9.4 Summary of study findings in relation to each objective

The findings of the study are presented in the following discussion where the findings are evaluated in the context of the study objectives.

Objective 1: Identify best practice interventions for preventing VAP, CRBSI and PU in the ICU

Chapter 1 and 2 have identified the best practices in preventing VAP, CRBSI, and PU in the ICU. Several changes in clinical practice were proposed to increase the focus on quality, safety and efficiency of the health care delivery[8, 9] by minimizing preventable adverse events, such as hospital-acquired infections. There has been attention focus on preventing ICU-related complications, such as CRBSI,[10, 11] VAP[12, 13] and PUs[14, 15] in the literature and from these reports it is clear that prevention measures were able to improve outcomes by limiting the spread of hospital-acquired infection.[16]

A core set of nursing practices, including hand washing,[17, 18] hygiene care,[19] including bathing,[20, 21] oral / subglottic suctioning,[19, 22-24] repositioning of the patient,[25, 26] elevation of the head of bed, [13, 24, 27-30] early mobilisation,[31, 32] use of support surface,[25, 26] providing adequate nutrition to patient,[25] PU risk assessment[33, 34,26] including assessment of patient's skin[33, 34, 26] assessing the need to send for blood culture and sensitivity[35, 36] for patient that shows sign and symptoms of infections were advocated to prevent ICU complications. These activities were included in evidence-based practice (EBP) guidelines recommended for implementation in the ICU.[11, 14, 33, 37-39]

A novel focus of the INVEST Study has been using a multi-pronged nursing care approach to reduce the three common ICU complications rather than focussing on a single condition. This is not to consider that each of these complications of equal weight and significance but to identify a core set of nursing outcomes that can influence behaviour. The focus of the intervention was empowering nurses to

implement and sustain EBP in the longer term and importantly to convince them that they had control over their own practice.

Objective 2: Document the current rates of VAP, CRBSI and PU in an ICU in Malaysia.

Chapters 2, 5 and 7 reported the rates of VAP, CRBSI and PU in the study setting. In pre-intervention, the combination of VAP, CRBSI and PU events were higher than in post-intervention - 18[40] *vs.* 10 patients, respectively (Chapter 7).

In pre-intervention, there were 21 cases of ICU complications in 18 of 91 patients (19.8%) admitted in December 2009.[40] Three of them had two complications - PU + VAP (two patients) and PU + CRBSI (one patient). In the post-intervention phase, there were 11 ICU complications in 10 (8.7%) of 115 patients admitted. One patient had VAP + PU, while four developed VAP and five PU. No CRBSI was detected in this phase.

The VAP and PU rates for Malaysian ICU populations are reported by the Malaysia National Audit of Adult ICU.[41-43] In 2003 - 2008, VAP decreased by over half from 28.0 to 13.5 per 1,000 ventilator-days.[42] The rates of VAP in this ICU studied were 26.2 and 29.7 per 1,000 ventilator days in 2003 and 2004, respectively. It dropped markedly to 6.8 and 8.2 per 1,000 ventilator days in 2005 and 2008, respectively.[42]

There are limited data on the CRBSI rate in Malaysia. CRBSI was diagnosed in 38 central venous catheters (CVC), giving an incidence of 9.43 per 1,000 catheter-days in a survey of 656 CVCs in 496 patients admitted to the ICU of Hospital Sultanah Aminah, Johor, Malaysia.[44] The highest infection rate (9.4%) was from CVCs inserted in the ICU compared to those inserted in the ward (2.8%) and operating theatre (1.4%).[44] A surveillance study in three ICUs in Malaysia to determine nosocomial infection associated with usage of devices found bacteraemia in 8.5% (n=11) of the patients after an average stay of 10.0 (5.0) days in an ICU.[45]

There are also limited data on the prevalence and incidence of PUs in ICUs in Malaysia including the study setting. There was no PU reported in this ICU in 2007 and 2008.[42] The Malaysia Registry of Intensive Care[43] reported PU incidence of 0 to 31.6 with mean of 7.7 per 1,000 ICU days in 2008 to 2009. This ICU had reported PU of 0.3 per 1,000 ICU days in 2009.[43] Shahin, Dassen, and Halfens[46] reported in their review of PU in ICU patients that the incidence of PU varies from one healthcare setting to another, with previous studies in intensive care settings giving 4 – 49% (prevalence) and 3.8 - 12.4% (incidence). The results suggest that the INVEST Study found lower PU rates than in other ICUs internationally. The low documented rates of PU in this ICU could be related to lack of understanding of what constitutes a PU and also poor documentation and reporting. In summary, a systematic documentation of the rates of complications is required as a benchmark for future quality improvement initiatives.

Objective 3: Implement an action research intervention to collaboratively develop and implement strategies for improvement

The action research methodology was planned and implemented after reviewing studies that applied it in ICU. The study method was combined with the findings from Objective One to develop the research tools for use in this study. This research consisted of 3 phases. During the intervention phase, the participants were followed up to identify their problem(s) encountered in implementation of EBP and to remedy them. The phases are presented below:

Pre Intervention

The first phase was implemented in December 2009, after the researcher had discussed the study with the participants - head, intensivists, nurse managers and nurses. They were explained the Center for Disease Control and Prevention (CDC) criteria for diagnosis of VAP[47] and CRBSI,[48] and the Waterlow Pressure Ulcer Risk

Assessment Scale.[49] A print-out for the diagnostic criteria for VAP and CRBSI, Waterlow PU assessment and staging of PU was distributed to the staff participants. A patient information form was developed for patient profiling. Pre-intervention data was collected over two months – an environmental scan including interviews with the key stakeholders, patient profiling and nurse survey was undertaken.

Pre intervention reflection

Reflecting on the data collected, it was revealed that the ICU was very busy with high bed demand, high patient turnover rate and limited resources such as ICU bed and staff. Some patients had to be ventilated and cared for by the staff in the ordinary wards although the patients 'qualified' to be in the ICU. This problem caused great stress and frustration to both the medical and nursing staff. There was an urgent to increase the resources to cater for the patient needs.

Nurses had good knowledge of infection control but barriers were evident because of embedded work practices and nurses feeling they had limited control over their practice. A hierarchical management and professional structure in the Malaysian health care system is evident with the nursing role subservient to the doctors. This finding suggested that it was necessary to empower the nurses so that they can act independently to detect and prevent complications, as well as changing practices earlier without having to get 'permission' from the doctors.

Intervention

The interventions were implemented over six months from February to July 2010. The CDC criteria to diagnose VAP and CRBSI, and the Waterlow Pressure Ulcer Risk Assessment Scale for PUs were again reiterated at this stage. The diagnostic criteria for VAP and CRBSI, Waterlow PU assessment tool, staging of PU and[50] CRBSI team checklist[33] were distributed to all the nurses together with a bag and 2 pens each. They were encouraged to implement evidence-based nursing

interventions, such as hand washing, and elevation of head of the bed >30 degrees. A 30^{o} head of bed measuring stick was provided at each ICU bed as a behavioural prompt to encourage the nurses to measure the bed elevation every time after positioning the patient. The stainless steel sponging basin was also changed to a disposable one. All the nurses were invited to the unit nursing education session to increase their knowledge and awareness on EBP in preventing ICU complications. Thirty eight (47%) nurses attended the session. In addition, bed side teaching was conducted on VAP, CRBSI and PU assessment and also the implementation of EBP. During the nursing education and bed side teaching, the nurses were encouraged to take control of their practice and use the assessment tools provided them to offer their patients better care. They were also encouraged to stop any procedure that violated the standard care practice such as hand washing.

Evidence-based practice articles were also provided to increase nurses knowledge level. Infection prevention posters, a reminder for nurses to practice hand washing, diagnostic criteria of VAP and a central catheter line insertion checklist were also put at the ICU bedside to create awareness about the changes being made. INVEST newsletters on the pre-intervention (baseline) patient profiles were also placed in the unit to increase their awareness on the current infection rate in the ICU. These approaches were all recommended from the literature as effective actions to support practice change, albeit outside the Malaysian context.[13, 51, 52]

Baseline data on the patients with complications were analysed and shared with the nurses during discussions and continuing education to provide an overview on the current status of ICU complications. Hand washing compliance rates, as observed by the infection control nurse in the hospital, were also presented to them and the intensivists to increase their awareness of the importance of hand washing in preventing infection. The baseline data on patients with complications were also shared during focus group discussions. The aim of the focus groups was to explore the nurses' experiences and reflections, including their challenges faced during the intervention period, and their perception of the advantages and disadvantages of applying evidence-based guidelines in the ICU. Based on feedback from the focus groups, the nurses found the A4-size VAP and CRBSI assessment criteria too bulky

to carry around to each patient. They (criteria) were therefore printed on a small tag which was wearable as a 'name tag'.

Intervention reflection

There was some early resistance to the changes introduced as was evident from the focus group discussions. Nevertheless, some of the nurses were positive that the changes can be adopted eventually through diffusion of knowledge and reflection on practice.

Some nurses still had difficulty differentiating between normal infection and VAP which indicated that they needed to improve their knowledge of the basic sciences. They also had limited knowledge about research methods, the value of striving for new methods to improved patient outcomes and the importance of assessment in nursing care. Some participant perceived the INVEST study to be just like any of the previous cross sectional surveys done in their unit and there was a low appreciation of the power of data to fuel clinical practice improvement. They thought that the changes in practice recommended for the study were just for the duration of the study to be stopped thereafter and return to their former routine. The nurses in this study may not have appreciated the importance of EBP due to their inability to relate research finding to their practice.[53]

Based on these findings, emphasis was given at the CNE sessions, bedside teaching or individually to improve their knowledge on the research being done, consider assessment as an important part of nursing care, and learn how to differentiate normal infection from VAP. Nurses were encouraged to read the articles provided to better understand EBP. However, some nurses approached inform the researcher that they did not read the articles due to their heavy workload, and most read only the abstracts.

Despite the hierarchical status between nurses and doctors in this ward, the nurses were encouraged to stop any procedures not complying with barriers

precautions or hand washing. They were asked to tell the doctors so in a firm but polite way, documenting the incident(s) and reporting to the ward manager or intensivist in charge any difficulty in dealing with non-compliant doctors from other departments. They were told that they can control their own practice, and encouraged to do so. The nurses might not have started reporting about this issue to nurse managers or intensivists yet due to the hierarchical health care system during this study period.

Post Intervention

The post-intervention study was from March to May 2011. The data collected included a review of patient medical records and relevant ICU documents. After the patient profiling was completed, the nurse survey was done. The same survey form was used for both pre- and post-intervention. A flowchart of the overall action research process is presented in Figure 9.1.

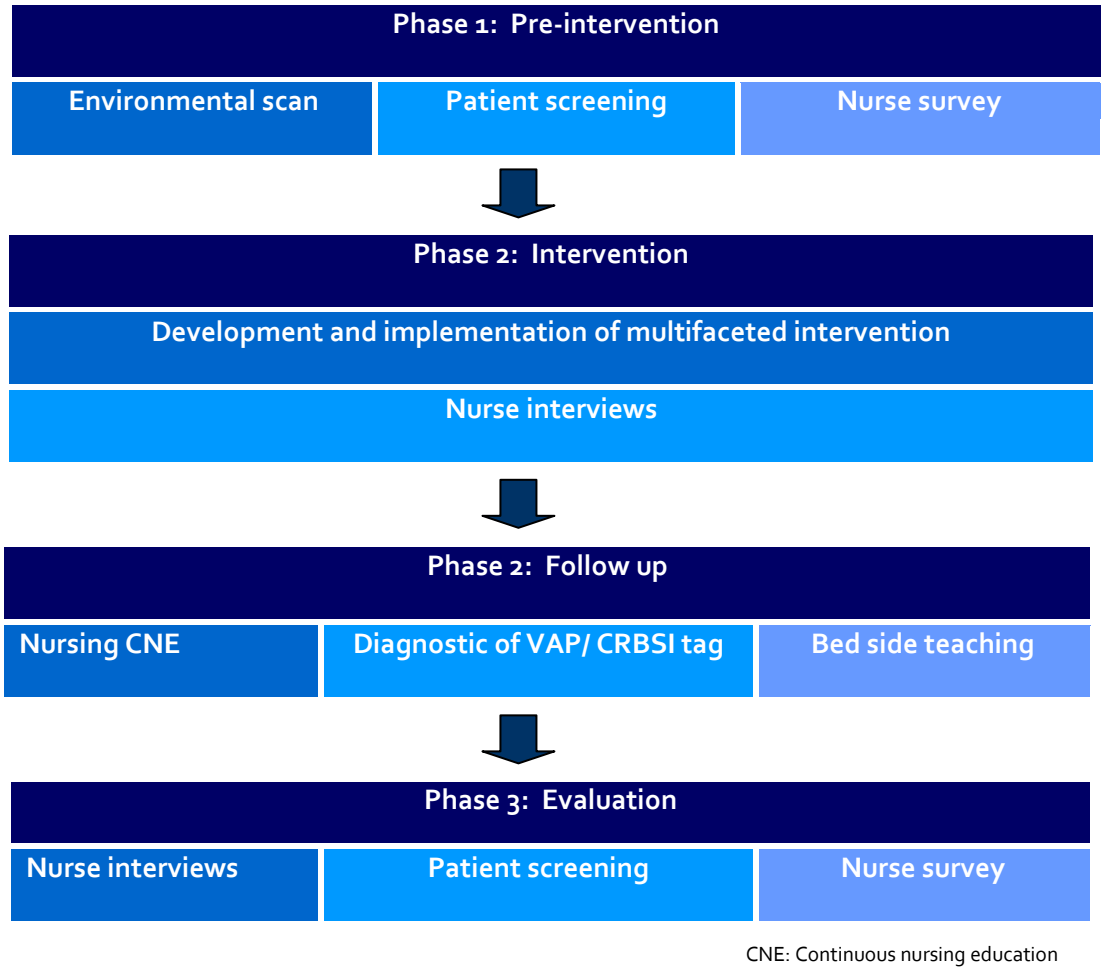

Figure 9.1 Flowchart of overall action research process

Post intervention reflection

Some nurses had adopted the changes. Nevertheless, some believed that the changes had improved their assessment knowledge and skills to offer better care to their patients. Some nurses did the Waterlow PU assessment but did not document it. Therefore, the culture of documentation needs to be emphasised and strengthened in the ICU. Some nurses suggested integrating the Waterlow PU assessment in the information system so that all nurses need to document the assessment. However, the directions for these recommendations need to come from management in order for these measures to be enacted and be successful.

In addition to the reflection on the findings of the surveys and focus groups, the researcher also reflects and describes about her experiences along the journey. This includes the motivations and problems that were encountered by her and also the factors that convinced her that this study did not go as well as initially planned.

During the study, the activity of the researcher in building supportive relationships, was perceived as being disturbing to the nurse manager although strongly supported by the medical staff. The nurse manager found the research time consuming and imposed too much additional work on her staff who were already overloaded. She felt that the researcher had taken too much of their time by having the focus groups and implementing the changes for the study. Although, she 'supported' the changes, she left the implementation to the individual willingness of the nurses – whether they could cope or were willing to cope. She was also unhappy that the researcher presented the hand washing compliance data from the hospital infection control team because the researcher was an *outsider* and an *insider* should have done it instead, notwithstanding the fact that she earlier granted permission for the presentation.

On reflection, the ward manager was not very receptive to the changes introduced, not being able to see the importance of the research to nursing practice. She was difficult to communicate with, often not receptive to discussion. She possibly agreed to the project in support of the medical director, the head of department, who had already agreed. The enthusiasm for the study was perhaps more from her colleagues (other nurse managers and senior nurses) and the head of department to improve patient care. This highlights the importance of having the full support of the team leader as opposed to only the team members, particularly in a hierarchical structure as existed within the study site.

During the study, the researcher also consulted the microbiologist, dietician and pharmacist for greater understanding on patient management and problems in the ICU. When chlorhexidine was not supplied to ICU, she discussed the matter with the pharmacist as an *outsider* to reinstate the antiseptic solution to the unit. An

action researcher requires excellent interpersonal skills as well as research ability[3] in addition to an understanding of the work culture in the area to be able to work across the traditional boundaries and juggle different, sometimes competing, agendas.[3]

Overall, the researcher believed that many of the nurses welcomed the opportunity and actively involved in the process. They appeared to understand the difficulties of the researcher's role. Sometimes, a senior ward manager gave confidential information to help the study succeed. She and some other nurses felt a responsibility to continue the project even after the researcher had left. A core group of participants gave the most support. They recognised and valued the researcher's enthusiasm and often commented on how much they had learnt during the study. On the other hand, some nurses were less positive. They tended to be the ones not interested in change and were just coming to work to do a job. They were often reluctant to engage in communication. However, they were not openly unreceptive with the exception of one or two. This could have been due to their lack of knowledge on the current need to implement EBP in patient care.

In summary, nurses are still felt that they are not the final decision maker and not confident and also afraid to do so due to the hierarchical structure in the organisation. Although they were empowered that they can control their own practice by the researcher, nurse managers, intensivist, and head of department (indirectly) however they still feel that they are dependent on the medical profession to be the final decision maker. Their current state may be due to their inadequate knowledge level in the patient management and the strong prevailing culture. Therefore, to avoid any errors they prefer to consults rather than making own decision in order to avoid punishment from the organisations. Given the multiple factors affecting nursing status in Malaysia the profession has a long road ahead in its journey to a position of empowerment.[54]

The nurses needed to be enlightened to the fact that modern nursing is not only about completing routine tasks. The job has progressed to greater professionalism to offer the complex health care needed. The key in today's complex health care environment is understanding the need to develop and sustain

EBP. The health care system needs to implement interventions that not only increase nurses' knowledge and skills, but also to strengthen their belief in the benefits of research and EBP.[55] The success of quality improvement projects is heavily dependent on a large majority of staff accepting and supporting the change agenda which was not the case ultimately in the study site.

Objective 3: Assess the impact of the intervention on clinical outcomes, staff dynamics, work place culture and sustainability of practice change

Implementing and sustaining EBP are not simple but always extremely challenging, especially in a developing country. The organisational factors and cultural influences that impact on the acceptability and sustainability of EBP need to be identified. Although this study was a small action research project with minimal funding, it may still have some impact on the clinical outcomes, staff dynamics, work place culture and sustainability of practice change if fully accepted and supported by the staff.

Impact on clinical outcomes

Considering the contribution of action research to knowledge, it is important to note that generalisations made from such studies often differ from those made from more conventional research.[3] Although reduction of PU was statistically significant, the clinical importance is hard to ascertain because other changes were concurrently taking place in the hospital making it difficult to attribute cause to effect. The hospital information system was changed in January 2011 and the nurses were under pressure to quickly adapt. This appeared to be another factor in limiting the effectiveness of the project. Although the INVEST Study cannot demonstrate causation, the results were still encouraging for future attempts to implement changes.

Impact on staff dynamics

The ICU had a large number of staff - 83 and 87 nurses in the pre- and post-intervention groups. So it was difficult to ensure that all the nurses were aware of the intervention strategies. In the CNE, for example, only 30-40 nurses came to the session. The staff dynamic found in this study indicated a lack of teamwork to accomplish patient assessments, as per a quote from Chapter 5:

> *Collaboration…helping each other not necessary it is my patient, I have to do it myself, other people also can do [Interview 1:14]*

In contrast some collaboration was seen when the nurses gave everyone a chance to do the Waterlow PU assessment.

> *… during night duty we distribute together (Waterlow PU assessment form) with the ICU chart for all patients in the ICU [Interview 1:82]*

Team dynamics can positively impact on patient care and improve / worsen the nurses engagement resulting in many positive/negative outcomes for the team.[22, 56] In order to fulfil the complex health care needs of the populations served by the health care providers, positive team dynamic is crucial for the delivery of high quality, safe patient care.[57]

Impact on work place culture

It was found that only minimal changes took place in the work culture and it appeared that the hierarchical structure in the unit persisted for the duration of the study. Even though nurses were empowered to control their practice, they seemed to prefer a more subservient role. This may be due to their lack of awareness of the recent advances in nursing roles. Birks et al[54] said that *unexamined acceptance* which represents Malaysian nurses acceptance of the status quo and their role in the

organisational status. Their lack of control over their practice can also be related to the organisational constraints and bureaucratic environment which limit decision making at the nursing level as top down authority is practiced in this ICU.

Impact on sustainability of practice change

The nurse survey found that the likelihood of sustaining the changed clinical practice was positive in the ICU. The mean sustainability indices for pre- and post-intervention were 75.21±SD 21.71 and 76.81± SD21.45, respectively, which are good scores for sustainability but this was partially demonstrated in the Waterlow risk assessment documentation. Out of the 115 patients whose medical records were examined, 75% did not have any documentation using the Waterlow assessment in their files. This is not to say that the assessment was not done, but merely that no documentation existed. During the project, a new hospital information system was installed. Based on feedback from the focus groups, the nurses concentrated on learning the system first and may have, therefore, overlooked documentation of Waterlow PU assessment but they said they have applied the interventions based on the risk assessment (Chapter 8). This demonstrates both a weakness and strength of the action research project. On one hand, it is difficult to control for confounders, while, on other hand, it recognizes the dynamic nature of the real world clinical practice setting.

9.5 Implications for nursing practice, education, research and policy

The findings of this thesis have implications for nursing practice, research and policies to prevent ICU related complications in Malaysian ICUs.

9.5.1 Implications for nursing practice

This study underscores the importance of increasing awareness of evidence-based strategies and how these impact on patient outcomes. The nurses still rigidly

adhered to their routine practice although some did implement strategies as part of the intervention as suggested. Rigid adherence will reduce the acceptance of change and, hence, implementation of EBP. This problem needs to be addressed because the current complexity of the health care system requires nurses to provide evidence of the quality of their care to patients. Nurses in the study setting need to take professional control and use evidence-based strategies.[1, 52, 58] There is need to examine nurse care practices and the processes around care to reduce the chances of adverse events so that they can create a patient-safe environment in the ICU. Nurses are expected to provide comprehensive, compassionate, complex and technological care without causing harm to their patients.[21] Thus, it is crucial that they critically evaluate their practice and play a more important role in healthcare effectiveness. Collaboration between nursing education, the nursing service and research is needed to improve the current nursing practice by ongoing monitoring of the practice provided patients.

9.5.2 Implications for nursing education

There is a need to increase the nurses' knowledge on basic sciences and EBP. Their lack of knowledge is worrying because this study found them unaware about staging PU or identifying VAP in its early development. If no early action is taken, there was the potential for patients to experience further complications and adverse events.

Implementing change process is challenging especially in settings with an embedded hierarchy structure. A clear position description and embedded competencies are needed on the current extended roles and responsibility of nurses. The description includes nurses' work authority especially in respect of implementing EBP on patient care.

Improving the level of education is likely to be critical stepping stone to improve issues related to hierarchical structure in the workplaces and work authority. This includes increasing the entry requirement to nursing education to an *Advanced level (A-level)* so that it can also help to improve the progress and development in

education and practice. Nurses need requisite competencies to deliver high quality care including leadership, health policy, system improvement, research, EBP, teamwork and collaboration.[59, 60] Revising and updating of nursing curricula is essential so that it is adaptive enough to change with patient's changing needs and improvement in science and technology to ensure delivery of safe patient care.[59] In addition, EBP is warranted in the nursing curricula at the diploma, graduate and postgraduate levels, as well as in continuing nursing education programs.

Continuing nursing education needs to be planned for longer times - at least a half day course - so that nurses have more time to engage in active learning. The present 30-60 minutes during working hours is not very effective because it is difficult to devote sufficient time and attention in a busy clinical environment. This lack of concentration is evidenced by a quote by a nurse (Chapter 6):

> *You can explain about the guidelines but the problem is…I cannot concentrate listening when I need to take care of the patient [Interview 4:165]*

Nurses' education should include applying research findings to clinical practice. In the current complex and challenging heath care system, nurses required more than knowledge to perform tasks and procedures.[61] Graduate nurses need to demonstrate critical reasoning and flexibility, execute a variety of roles throughout their careers, and become the leaders in health promotion and disease prevention.[61] Raising the entry standards to a nursing degree and running Master's programmes will raise the quality of nurses produced.[62] A more educated workforce at the undergraduate or postgraduate level would be better equipped to meet the demands of the current evolving health care system.[59] They also would be able to play more advanced roles in integrating research findings in patient care.[62, 63]

9.5.3 Implications for research

This study found that nurses in this study did not highly value research. This is perhaps because nurse training is still in its infancy in the country.[64] The majority of nurses were diploma trained,[64] and only acquainted with the rudiments of research in their training, not enough for them to appreciate the relevance of research to practice. In this study, the nurses did not value research, dismissing it as *other people's study* as per a quote:

> *...oh this...(Waterlow pressure ulcer assessment) somebody want to learn to do research...this is not important and not compulsory.(Interview 3: 145)*

This comment illustrates that there is not a perceived benefit for patient care from research. There is a need to have nurses with sufficient research capability to reduce the research and practice gap, and also for growth of the nursing profession.[65, 66] The increasing responsibility undertaken by nurses demand their efficient and safe performance by adopting set standards.[66] This can be achieved by implementing EBP.[66] In order to improve the research mindset of nurses in Malaysia, there is a need to increase their knowledge and awareness of the importance of applying research to practice to improve focus on patient care. Policy makers, nursing administrators and educational administrators need to collaborate to target student and graduate nurses so that this awareness can be driven from the root to the top of the nursing profession.

9.5.4 Implications for policy

Inadequate knowledge and awareness about EBP can contribute to suboptimal care. This study can be a benchmark for future quality improvement in Malaysian ICUs. There is a need to have partnerships between clinicians, researchers and policy makers to provide support for integration of research and policy in practice to improve patient outcomes. Any change process that encountered any competing interest during implementation such as the IT system has to be integrated in the new system. This includes the Waterlow pressure ulcer risk

assessment tool need to be integrated into the IT system before it is started so that both change process will be carried on by the nurses at the same time.

There is also a need to move beyond the rhetoric to enhance greater awareness amongst nurses on the underlying values of applying EBP in patient care. Strategies to promote regular continuous nursing education (CNE) are important at the unit, organisation and the health care system levels for professional development. It is important to plan CNE systematically, targeting nurses in the country so that they have updated knowledge on EBP and become able to practice EBP. Nurses also require knowledge, skills and educational support to become experts in their fields. Reflective supportive and enabling structures are needed to support workplace cultures to become more conducive and supportive of change.[67]

In addition, there is also a need to improve the interprofessional collaboration and respect in the workplace in order to improve the hierarchical norm in Malaysia. Interprofessional collaborative recognizes and values the expertise, as well as the separate and shared knowledge and skills, of all health professionals, and leads to a participatory, collaborative and coordinated approach to improve patient care.[68] This is guided by shared values, mutual respect, and effective communications to optimise participation in clinical decision-making within and across professions.[68] Nurses represent the largest segment of the Malaysian health care workforce.[60] Therefore more support needs to be provided to nurses so that their voice can be heard in health system management. The opportunities also should be given to nurses to be involved in health sector management and policy decision making. In the health policy arena nurses should be actively involved in decision making and be engaged in health care reform.[60] They also should also participate on advisory boards on which policy decision are made to advance health care system and improve patient care.[60] By acting as a full partner in clinical redesign initiatives, being accountable for delivering high quality care, working collaboratively effectively and efficiently with other health care profession[60] is critical to achieve the best health outcomes for patients.

9.6 Conclusions

In conclusion, this chapter has summarised the findings from the INVEST Study and made recommendations to improve application of the research results in nursing practice. Although this is a single site study, it has provided a foundation to inform and plan clinical practice improvement initiatives in Malaysian ICUs. The first step in ensuring this goal should be raising the nurses' knowledge and awareness on the importance of implementing EBP in their daily work and introducing processes to promote systems based changes that can be advantageous in the ICU and clinical setting. Collaboration in future nursing practice - between education, research and policy - is crucial to achieve improvement in the nursing practice. As indicated by Bellman and colleagues,[67] in order to achieve knowledge transfer, a systematic, robust process needs to be in place to enable it to occur. Advancing the nursing profession in Malaysia is essential for patient safety and quality of care delivered to patients in order to produce better long-term results.

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Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.

Appendix One

Environmental Scan Issues Log

Appendix 1 Environmental scan issues log

INVEST PROJECT ISSUES LOG

Date:

Time:

Stakeholder:

Observer/Interviewer

Barrier	Facilitator	Action	Review/Resolution

Comments

Appendix Two

Patient Profiling Instrument

Appendix 2 Patient profiling

PATIENT PROFILING

Section One – Patient Information

Patient name:__ __ __ __ __ __ __ ____ __ __ __ I/C: __ __ __ __ __ __ _ R/N:__ __ __ __

Age: __ __ __ __ Sex: __ __ __ __ Ethnicity:__ __ __ __

Time of admission: __ __ __ Date of admission: __ __ /__ __ /__ __ __ __

Diagnosis on admission (state): __ ____ __ __ __ __ __ __ __ __ __ __ __ __ __

Length of ICU stay:__ __ __ __

Date of discharge from ICU: __ __ /__ __ /__ __ __ __ Dead ☐$_0$ Alive ☐$_1$

Transfer to: __ __ __

Cause of death/Diagnosis on transfer (state) :__ ____ __ __ __ __ __ __ ___ ____ __ __ __

Section Two: General Information

1. Type of admission	
Emergency	☐$_1$
Elective	☐$_2$
2. Transfer in from:	
Accident and Emergency	☐$_1$
Operation Theatre	☐$_2$
Ward	☐$_3$
Other	Please specify _____
3. Refer case (Date refer:__ __ /__ __ /__ __ __ __)	Please specify _____
4. Co morbidities on admission – See Charlson Index of Comorbidity	
5. Glasgow Coma Scale	Total : _____
6. SAP II Score	Total : _____
7. SOFA Score	Total : _____
8. Type of nosocomial infection	
Pneumonia	☐$_1$
Catheter related blood stream infection	☐$_2$
Pressure ulcer	☐$_3$
Stage of Pressure ulcer	Please specify_____

9. Microbiology report (positive culture)	
Date collected	__ __ /__ __ /__ __ __ __
10. Time of pressure ulcer detected	
Date	__ __ /__ __ /__ __ __ __
During admission to ICU	☐1
Intensive Care Unit	☐2
Length of stay in ICU	Please specify_____
11. Type of specimen	
Tracheal	☐1
Blood	☐2
Swab	☐3
Other	Please specify_____
12. Organism isolated	
Acinetobacter baumanni	☐1
Burkholderia (pseudo) mallei	☐2
Burkholderia cepacia	☐3
Enterobacter cloacae	☐4
Enterobacter aerogenous	☐5
Escherichia coli	☐6
Klebsiella pneumonia	☐7
Klebsiella terigena	☐8
MRSA	☐9
Pantoea spp	☐10
Proteus vulgaris	☐11
Psedomanas aeruginosa	☐12
Pseudo stenophomonas	☐13
Serratia marcescens	☐14
Staphylococcus aureus	☐15

Staphylococcus coagulase negative		☐16	
Stenotrophomonas maltophilia		☐17	
Streptococcus		☐18	
Other		Please specify_____	
13.Predisposing factors			
Underlying disease causing the infection		☐1	
		Please specify_____	
Immunosuppressive therapy		☐2	
Prolonged hospitalization (> 2 weeks)		☐3	
Invasive procedure		☐4	
Mechanical ventilator		Date insertion:__ __ /__ __ /__ __ __ __ Date removal:__ __ /__ __ /__ __ __ __	
Tracheostomy		Date insertion:__ __ /__ __ /__ __ __ __ Date removal: __ __ /__ __ /__ __ __ __	
Central venous catheter		Date insertion:__ __ /__ __ /__ __ __ __ Date removal:__ __ /__ __ /__ __ __ __	
Nasogastric tube		Date insertion:__ __ /__ __ /__ __ __ __ Date removal:__ __ /__ __ /__ __ __ __	
Urinary catheterisation		Date insertion:__ __ /__ __ /__ __ __ __ Date removal: __ __ /__ __ /__ __ __ __	
14. Central line catheter inserted in:		15. Site of insertion:	
Intensive Care Unit	☐1	Subclavian	☐1
Operation Theatre	☐2	Femoral	☐2
Accident and Emergency	☐3	Internal jugular	☐3
Ward	☐4	Peripheral	☐4
Other (Please specify_____)			
16. Intubation in:		17. Intubation	
Intensive Care Unit	☐1	Oral	☐1
Operation Theatre	☐2	Nasal	☐2
Accident and Emergency	☐3	Tracheostomy	☐3
Ward	☐4	Multiple intubations	☐4
Other (Please specify_____)		Please specify_____	

Charlson Index of Comorbidity			
Myocardial infarction	Yes☐1 No ☐$_0$	AIDS	Yes☐$_1$ No ☐$_0$
Congestive heart failure	Yes☐$_1$ No ☐$_0$	Hemiplegia	Yes☐$_1$ No ☐$_0$
Peripheral vascular disease	Yes☐$_1$ No ☐$_0$	Any tumour	Yes☐$_1$ No ☐$_0$
Cerebrovascular disease	Yes☐$_1$ No ☐$_0$	Leukemia	Yes☐$_1$ No ☐$_0$
Dementia	Yes☐$_1$ No ☐$_0$	Lymphoma	Yes☐$_1$ No ☐$_0$
Chronic pulmonary disease	Yes☐$_1$ No ☐$_0$	Ulcer disease	Yes☐$_1$ No ☐$_0$
Connective tissue disease	Yes☐$_1$ No ☐$_0$		
Renal disease	Yes☐$_1$ No ☐$_0$		
Renal disease with mod/end organ damage		Yes☐$_1$ No ☐$_0$	
Diabetes mellitus	Yes☐1 No ☐$_0$		
Diabetes mellitus with mod/end organ damage		Yes☐$_1$ No ☐$_0$	
Mild liver disease	Yes☐$_1$ No ☐$_0$		
Liver disease with mod/severe organ damage		Yes☐$_1$ No ☐$_0$	
Malignant solid tumour	Yes☐$_1$ No ☐$_0$		
Malignant solid tumour with mod/severe organ damage		Yes☐$_1$ No ☐$_0$	
Comorbidity Score:__ ____ __			

19. Arterial Blood Gases (ICU admission)	
PH _____	No data ☐$_0$
PCO_2 _____ mmHg	No data ☐$_0$
PO_2 _____ mmHg	No data ☐$_0$
sO_2 _____%	No data ☐$_0$
FiO_2 _____	No data ☐$_0$

20. Biochemistry (ICU admission)	
Creatinine _____umol/l	No data ☐0
Urea _____ mmol/l	No data ☐0
Na _____ mmol/l	No data ☐0
K _____ mmol/l	No data ☐0
CL _____ mmol/l	No data ☐0
Gluc _____mmol/l	No data ☐0
Total bilirubin _____umol/L	No data ☐0
Total protein _____ gm/dL	No data ☐0
Alk phos _____iu/l	No data ☐0
GGT _____U/l	No data ☐0
Total chol _____ mmol/l	No data ☐0
Trigl _____ mmol/l	No data ☐0
LDL _____mmol/l	No data ☐0
HDL _____mmol/L	No data ☐0
Plts _____10^9/L	No data ☐0
Hct _____ %	No data ☐0
INR _____	No data ☐0
Bicarbonate _____mmol/l	No data ☐0
Albumin _____mg/d	No data ☐0
ALT _____U/L	No data ☐0
Troponin I _____ug/L	No data ☐0
HbA1c _____ %	No data ☐0
FT4 _____pmol/L	No data ☐0
FT3 _____pmol/L	No data ☐0
RBC _____10^12/L	No data ☐0
Hb _____g/L	No data ☐0
WCC _____ 10^9/L	No data ☐0
Fibrinogen _____g/L	No data ☐0

21. Discharge status summary in ICU:

……

……

……

……

……

……

Name:_____ Date: __ __ /__ __ /__ __ __ __

22. Discharge status summary in hospital:

……

……

……

……

……

……

Dead ☐$_0$ Alive ☐$_1$

Cause of death/diagnosis on discharge: __ ____ __ __ __ __ __ __ __ __ __ _

Discharge to: Home, ☐$_1$ Residential aged care ☐$_2$

Ward length of stay: __ __ __ __ __ __ __

Hospital length of stay: __ __ __ __ __ __ __

No of ICU admissions during stay: __ __ __ __ __ __ __

Name:_____ Date: __ __ /__ __ /__ __ __ __

Appendix Three

Nurse Survey

Appendix 3 Nurse survey

Section One: General Information

We would like to know just a little about your background so we can see how different people feel about the topics covered in this questionnaire.

Please answer all questions. Most questions require you to tick a box to indicate your answer. Choose the box that best matches your answer.

1. Gender	Female ☐1 Male ☐0
2. Date of birth	D D / M M / Y Y Y Y
3. How many years have you worked as a nurse?	_____ years
4. How many years have you worked in ICU?	_____ years
5. Are you a:	
Ward Manager/ Sister	☐1
Registered Nurse	☐2
Others	☐3
	*Please specify*_____
6. What shift do you usually work in the ICU?	
Morning	☐1
Afternoon	☐2
Night	☐3
Office hour	☐4
7. First nursing qualification (please tick one box only)	
3 years certificate programme	☐1
3 years diploma programme	☐2
Bachelor Degree	☐4
Others	*Please specify*_____

8. Highest nursing qualification (*please tick one box only*)	
3 years certificate programme	☐1
3 years diploma programme	☐2
Post basic critical care	☐3
Bachelor Degree	☐4
Master Degree	☐5
Others	*Please specify*_____
9. How many articles related to evidence based practice did you read each year	
Nil	☐1
One	☐2
Two	☐3
More than three	☐4
10. Would you like to learn more about the evidence based practice for nursing in the ICU	
Yes	☐1
No	☐2
Not sure	☐3
11. When was the last time you attended a lecture on pressure ulcers?	
1 year or less	☐1
2-3 years	☐2
4 years or greater	☐3
12. When was the last time you read article about pressure ulcers?	
1 year or less	☐1
2-3 years	☐2
4 years or greater	☐3

Section Two: Working Environment

We would like to ask you about your working environment

Direction: Please circle the ONE response that best reflects your level of agreement.

Component	Strongly disagree	Disagree	Agree	Strongly agree
1. Handling disagreement and conflict				
1. When staff disagree, they ignore the issue pretending that it will "go away".	1	2	3	4
2. Staff withdraw from conflict.	1	2	3	4
3. Disagreement between staff members are ignore/avoided.	1	2	3	4
4. All contribute from their experience, expertise to effect high-quality solution.	1	2	3	4
5. All staff member work hard to arrive at best possible solution.	1	2	3	4
6. All points of view considered in finding best possible solution to problem.	1	2	3	4
7. Staff involved do not settle dispute until all are satisfied with decision.	1	2	3	4
8. Most conflict occur with members of my own discipline.	1	2	3	4
9. Staff member involved settle disputes by consensus.	1	2	3	4
2. Leadership and autonomy in clinical practice				
10. Department head supports staff even if conflict is with a physician.	1	2	3	4
11. Leadership supportive to department/unit staff.	1	2	3	4
12. Department head is good manager and leader.	1	2	3	4
13. My discipline controls its own practice.	1	2	3	4
14. I have freedom to make important patient care and work decision.	1	2	3	4

Component		Strongly disagree	Disagree	Agree	Strongly agree
3. Internal work motivation					
15.	I have challenging work that motivates me to do the best job I can.	1	2	3	4
16.	Working on this unit gives me opportunity to gain new knowledge and skills.	1	2	3	4
17.	I feel a great sense of personal satisfaction when I do this job well.	1	2	3	4
18.	I feel high degree of personal responsibility for work I do.	1	2	3	4
19.	Working in this environment increases my sense of professional growth.	1	2	3	4
20.	I'm motivated to do well because I'm empowered by my work environment.	1	2	3	4
21.	My opinion of myself goes up when I work on this unit.	1	2	3	4
22.	I feel bad and unhappy when I discover I have performed less well that I should.	1	2	3	4
4. Control over practice					
23.	There are enough staff to provide quality patient care.	1	2	3	4
24.	We have enough staff to get the work done.	1	2	3	4
25.	I have enough time and opportunity to discuss patient care problem with other staff.	1	2	3	4
26.	I have adequate support services to allow me to spend time with patients.	1	2	3	4
27.	There are opportunity to work on highly specialized patient care unit.	1	2	3	4
5. Teamwork					
28.	Inadequate working relationship with other hospital groups limit effectiveness of work on this unit.	1	2	3	4
29.	My unit/department does not get the cooperation it needs from other hospital units.	1	2	3	4
30.	Other hospital unit/department seem to have low opinion of my unit/department.	1	2	3	4
31.	My unit/department has constructive relationship with other groups in this hospital.	1	2	3	4

Component	Strongly disagree	Disagree	Agree	Strongly agree
6. Communication about patient				
32. I receive information quickly when patient's status changes.	1	2	3	4
33. Information regarding patient care is relayed without delays.	1	2	3	4
34. Information on the status of patients is available when I need it.	1	2	3	4
7. Cultural sensitivity				
35. Staff member are sensitive to diverse patients populations for whom they serve.	1	2	3	4
36. Staff member respect the diversity of their health care team.	1	2	3	4
37. Staff member have access to necessary resources to provide culturally competent care.	1	2	3	4
8. Staff relationship with physicians				
38. Physicians and staff have good working relationships.	1	2	3	4
39. There is a lot of teamwork between unit/departments and physicians.	1	2	3	4

Section Three: Sustainability

This questionnaire asks for your views about implementing practice change in the ICU
For each of the following questions, please mark an ☒ in the one box that best describes the strategies we have implemented to improve nursing practice – eg Waterlow pressure area chart

1. Benefits beyond helping patients	
☐1	The change improves efficiency and makes jobs easier
☐2	The change improves efficiency but does not make jobs easier
☐3	The change does not improve efficiency but does make jobs easier
☐4	The change neither improves efficiency nor makes jobs easier
2. Credibility of the benefits	
☐1	Benefits of the change are immediately obvious supported by evidence and believed by staff in the ICU and hospital administrators
☐2	Benefits of the change are not immediately obvious even though they are supported by evidence and believed by staff in the ICU and hospital administrators
☐3	Benefits of the change are not immediately obvious even though they are supported by evidence. They are not believed by staff in the ICU
☐4	Benefits of the change are neither immediately obvious supported by evidence nor believed by staff in the ICU
3. Adaptability of improved process	
☐1	The process can be adapted to other organisational changes and there is a system for continually improving the process
☐2	The process can be adapted to other organisational changes but there is no system for continually improving the process
☐3	The process is not able to adapt to other organisational changes but there is a system for continually improving the process
☐4	The process is not able to adapt to other organisational changes and there is no system for continually improving the process

4. Effectiveness of the system to monitor progress

☐1 There is a system in place to identify evidence of progress, monitor progress, act on it and communicate results

☐2 There is a system in place to identify evidence of progress and act on it, but the results are not communicated

☐3 There is a system in place to identify evidence and monitor progress. The results are communicated but no one acts on them

☐4 There is no system in place to identify evidence of progress or to monitor progress nor act or communicate it

5. Staff involvement and training to sustain the process

☐1 Staff have been involved from the beginning of the change and adequately trained to sustain the improved process

☐2 Staff have been involved from the beginning of the change but not adequately trained to sustain the improved process

☐3 Staff have not been involved from the beginning of the change but they have been adequately trained to sustain the improved process

☐4 Staff have neither been involved from the beginning nor adequately trained to sustain the improved process

6. Staff attitudes toward sustaining the change

☐1 Staff feel empowered as part of the change process and believe the improvement will be sustained

☐2 Staff feel empowered as part of the change process but don't believe the improvement will be sustained

☐3 Staff don't feel empowered by the change process but believe the improvement will be sustained

☐4 Staff don't feel empowered by the change process or believe the improvement will be sustained

7. Senior leadership engagement

☐1 Organisational leaders take responsibility for efforts to sustain the change process and staff generally share information with and actively seek advice from the leader

☐2 Organisational leaders don't take responsibility for efforts to sustain the change process but staff generally share information with and seek advice from the leader

☐3 Organisational leaders take responsibility for efforts to sustain the change process but staff typically don't share information with or seek advice from the leader

☐4 Organisational leaders don't take responsibility for efforts to sustain the change process and staff typically do not share information with or seek advice from the leader

8. Clinical leadership engagement

☐1 Clinical leaders take responsibility for efforts to sustain the change process and staff generally share information with and actively seek advice from the leader

☐2 Clinical leaders don't take responsibility for efforts to sustain the change process but staff generally share information with and actively seek advice from the leader

☐3 Clinical leaders take responsibility for the efforts to sustain the change process but staff typically do not share information with or actively seek advice from the leader

☐4 Clinical leaders don't take responsibility for efforts to sustain the change process and staff typically do not share information with or actively seek advice from the leader

9. Fit with the organisation's strategic aims and culture

☐1 There is a history of successful sustainability improvement goals are consistent with the organisation's strategic aims

☐2 There is a history of successful sustainability but the improvement and organisation is strategic aims are inconsistent

☐3 There is no history of successful sustainability but the improvement goals are consistent with the organisation's strategic aims

☐4 There is no history of successful sustainability and the improvement goals are inconsistent with the organisation's strategic aims

10. **Infrastructure for sustainability**

☐1 Staff, facilities and equipment, job descriptions, policies, procedures and communication systems are appropriate for sustaining the improved process

☐2 There is an appropriate level of staff, facilities and equipment, but inadequate job descriptions, policies, procedures and communication systems for sustaining the change

☐3 The levels of staff, facilities and equipment to sustain the change are not appropriate although job descriptions, policies, procedures and communication systems are adequate

☐4 The staff, facilities and equipment, job descriptions, policies and procedures and communication systems are all not appropriate for sustaining the change

Section Four: Nursing Practice in ICU

Please indicate to what extent do you agree with statement below:

For each of the following questions, please mark an ☒ in the one box that best describes your agreement.

	Knowledge	◄ Do not agree									Strongly Agree
		1	2	3	4	5	6	7	8	9	10
1.	Hand washing is important to prevent cross infection										
2.	Alcoholic antiseptic solution is recommended compared to soap for hand washing										
3.	Regular positioning of patients can help to prevent ventilator associated pneumonia and pressure ulcers										
4.	Elevation of the head of bed more than 30 degree is recommended for all ventilated patients										
5.	Chlorhexidine is recommended in prevention of ventilated-associated pneumonia and catheter related blood stream infection										
6.	Enteral nutrition should be started immediately for all ventilated patients with no contraindication.										
7.	Maximal barrier precautions are recommended to prevent infections in ICU.										
8.	Early mobilization reduces ICU complications										
9.	Subglottic suctioning can prevent microaspiration in ventilated patients.										
10.	Blood or tracheal secretions culture and sensitivity is recommended if patient shows signs and symptoms of infection										
11.	Exposure to evidence based practice can help nurses to prevent ventilated-associated pneumonia, catheter related blood stream infection and pressure ulcer										
12.	Hygiene care help to reduces infection for ICU patients										
13.	Assessment of pressure area is indicated for all ICU patients										
14.	Each patient shows specific signs and symptoms if he/she develops ventilated-associated pneumonia or catheter related blood stream infection										

Thank you for completing the survey!

Appendix Four

Human Research Ethics Approval Documents

Appendix 4.1 Malaysia Ministry of Health Medical Research Ethics Committee

PEJABAT TIMBALAN KETUA PENGARAH KESIHATAN
OFFICE OF THE DEPUTY DIRECTOR-GENERAL OF HEALTH
(PENYELIDIKAN & SOKONGAN TEKNIKAL)
(RESEARCH & TECHNICAL SUPPORT)
KEMENTERIAN KESIHATAN MALAYSIA
MINISTRY OF HEALTH MALAYSIA
Aras 12, Blok E7, Parsel E, Presint 1
Level 12, Block E7, Parcel E, Precinct 1
Pusat Pentadbiran Kerajaan Persekutuan
Federal Government Administrative Centre
62590 PUTRAJAYA

Tel : 03 88832543
Faks : 03 88895184

JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN
KEMENTERIAN KESIHATAN MALAYSIA
d/a Institut Pengurusan Kesihatan
Jalan Rumah Sakit, Bangsar
59000 Kuala Lumpur

Ruj. Kami : (2) dlm.KKM/NIHSEC/08/0804/P09-

Tarikh : 7 Januari 2010

Cik Soh Kim Lam
Jabatan Perubatan
Fakulti Perubatan dan Sains Kesihatan
Universit Putra Malaysia

Puan,

NMRR-09-1019-4945
Improving Health Outcomes by Preventing Intensive Care Related Infection in Malaysia Intensive Care Unit (INVEST Study)

Lokasi projek : Hospital Sultanah Nur Zahirah

Dengan hormatnya perkara di atas adalah dirujuk.

2. Jawatankuasa Etika & Penyelidikan Perubatan (JEPP), Kementerian Kesihatan Malaysia (KKM) tiada halangan, dari segi etika, ke atas pelaksanaan kajian tersebut. JEPP mengambil maklum bahawa kajian tersebut tidak mempunyai intervensi klinikal ke atas subjek dan merupakan kajian pemerhatian yang hanya melibatkan pengumpulan data melalui borang soal selidk sahaja.

3. Segala rekod dan data subjek adalah SULIT dan hanya digunakan untuk tujuan kajian dan semua isu serta prosedur mengenai *data confidentiality* mesti dipatuhi. Kebenaran daripada Pengarah hospital di mana kajian akan dijalankan mesti diperolehi terlebih dahulu sebelum kajian dijalankan. Puan perlu akur dan mematuhi keputusan tersebut.

4. Laporan tamat kajian dan sebarang penerbitan dari kajian ini hendaklah dikemukakan kepada Jawatankuasa Etika & Penyelidikan Perubatan selepas tamatnya kajian ini.

Sekian terima kasih.

BERKHIDMAT UNTUK NEGARA

Saya yang menurut perintah,

(DATO' DR CHANG KIAN MENG)
Pengerusi
Jawatankuasa Etika & Penyelidikan Perubatan
Kementerian Kesihatan Malaysia

Appendix 4.2 Curtin Human Research Ethics Committee

memorandum

To	Professor Patricia Davidson, Nursing & Midwifery
From	A/Professor Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 33/2010**
Date	1 June 2010
Copy	Soh Kim Lam Nursing & Midwifery Graduate Studies Officer, Faculty of Health Sciences

Curtin University of Technology

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for providing the additional information for the project titled "*Improving health outcomes be preventing intensive care related infection in Malaysia intensive care unit (INVEST study)*". The information you have provided has satisfactorily addressed the queries raised by the Committee. Your application is now **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 33/2010.** *Please quote this number in any future correspondence*.
- Approval of this project is for a period of twelve months **26-05-2010** to **26-05-2011**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **26-05-2011**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 33/2010). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards,

A/Professor Stephan Millett
Chair Human Research Ethics Committee

Appendix Five

Participant Information Sheet

Appendix 5 Participant information sheet

Participant Information Sheet

Project title

Improving health outcomes by preventing intensive care related infection in a Malaysia intensive care unit (INVEST Study)

Why have I been invited to participate in this study?

All nurses working in the intensive care unit at Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia are invited to participate in a study designed to decrease the rated of three serious and common adverse events in the ICU- (1) ventilator-associated pneumonia (VAP); (2) catheter related blood stream infection (CRBSI); and (3) pressure ulcers (PUs).

What is the purpose of the study?

The purpose of the study is to collaboratively develop a program within the Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia to improve outcomes for VAP, CRBSI and PUs. As part of this process information about nurses' knowledge on ventilator-associated pneumonia (VAP), catheter related blood stream infection (CRBSI), pressure ulcers (PUs) for the ventilated patients and the practice environment will be collected.

This information will be used to develop an intervention to decrease the rate of VAP, CRBSI and PUs in the intensive care unit (ICU). This intervention will involve a critical review of clinical practice, specifically the rates of VAP, CRBSI and PUs within your unit and the implementation of interventions, tailored to the Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia, to implement evidence based interventions and improve clinical outcomes.

What happens in the study?

If you agree to participate you are encouraged to complete baseline questionnaire, to describe your knowledge, attitudes and beliefs regarding common complications in the ICU and your views about your practice environment. This questionnaire will also ask for information such as your age and educational qualifications. After completion you are asked to put the completed questionnaire in the enclosed envelope and place into the box provided in the Sister's office in the ICU at Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia.

The researcher will collect all the questionnaires after three weeks. When the questionnaires are returned, data will be analysed and feedback will be given as aggregated data to all clinicians in the ICU. Your responses and answers to the questions will not identify you in any way. You may also be requested to participate in focus groups, group interviews which will be audiotaped with your consent. You can e- mail the research team if you want a summary of the results when the study is complete.
After baseline data has been collected, all staff members will be required to participate in a quality improvement process to increase the awareness of staff and implement evidence based strategies and methods for monitoring outcomes relating to VAP, CRBSI and PUs. This process has been approved by the Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia.

What if I don't want to take part in this study, or if I want to withdraw later?

Participation in this study is voluntary. It is completely up to you whether or not you complete questionnaires or participate in interviews. If you decide not to participate, it will not affect your employment now or in the future. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason.

What are the risks?

There are no anticipated risks of participating in this study. However, as you are asked to reflect on your practice, this may evoke some distressing memories. Appropriate counseling services will be organized with the Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia. In addition, you are free to discuss your concerns confidentially with Professor Patricia Davidson whose details are provided below.

How long will this take?

Approximately 15 -20 minutes is needed to complete a questionnaire before the study and again in six months time. You will also be invited to participate in group discussions which will be conducted within scheduled work time and at the discretion of the nursing unit manager. Participation in the study will not involve additional time other than your scheduled hours at Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia.

What are the benefits?

The information gathered will be used to gain further understanding about the challenges faced by health professionals in preventing adverse events in the ICU. This information will assist in developing strategies to improve the patient care and patient health outcomes in the intensive care unit.

Are there any cost associated with participation?

Other than your time there will not be costs associated with participation in the INVEST study. This study has been approved by the management of the ICU at Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia and participation will be in scheduled work time.

How is my privacy protected?

To ensure your confidentiality, your name will not appear anywhere on the data collection forms. At no time the researcher have access to your name or any contact information unless you personally provide it to them. If any publications or presentations result from this research you will not be identified by name. Please do not write your name or address details on study documents to ensure that the researcher has no way to identify you.

What happens with the results?

If you give us your permission by agreeing to participate in the survey and or, signing the consent document, we plan to discuss/publish the results in scientific journals, at scientific meetings and at professional workshops. The data collected from this study will also be part of the PhD thesis of Soh Kim Lam, being undertaken at Curtin University and also be used to inform quality improvement initiatives at Sultanah Nur Zahirah Hospital, Kuala Terengganu, Malaysia. In any publication or presentation, information will be provided in such a way that you cannot be identified. Results of the study will be provided to you, if you wish.

What should I do if I want to discuss this study further before I decide?

When you have read this information, the researcher, Soh Kim Lam, will discuss it with you and any queries you may have. If you would like to know more at any stage, please do not hesitate to contact her on +60 19 9676851. Contact details for Professor Patricia Davidson are provided below:

Professor Patricia Davidson
Professor of Cardiovascular and Chronic Care
Curtin University of Technology
Phone: +61 2 83997831
Facsimile: +61 2 83997834
Email: P.Davidson@curtin.edu.au

Who should I contact if I have concerns about the conduct of this study?

This study has been approved by Curtin University Human Research Ethics Committee and the Ministry of Health Medical Research Ethics Committee, Malaysia. Any person with concerns or complaints about the conduct of this study should contact the Research Governance Officer on Ph: 61-8- 9266 2784, Fax: 61-8 9266 3793 or Email: hrec@curtin.edu.au and quote the HREC project number HR 33/2010

Thank you for taking the time to consider this study. This information sheet is for you to keep.

Appendix Six

Permission to Reproduced Publication

Arising From This Thesis

Appendix 6.1 Permission to reproduced article for review of action research

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Expected completion date	Mar 2012
Estimated size (number of pages)	200

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Appendix 6.2 Permission to reproduced article for Phase One

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Tracey Heers, Marketing Manager, eContent Management [marketing@e-contentmanagement.com]
You replied on 6/10/2011 5:47 AM.
To: Kim Soh
Cc:

Dear Kim

You have our permission to reproduce Soh, KL, et al., *Factors to drive clinical practice improvement in a Malaysian intensive care unit: Assessment of organizational readiness using a mixed method approach.* International Journal of Multiple Research Approaches, 2011. **5**(1): p. 104-121 for the purposes you mention.

Our condition is that you provide a full citation of author, date, title, publisher, ISBN and URL: http://mra.e-contentmanagement.com/archives/vol/5/issue/1/mixed-methods-research-in-the-health-sciences

Kind Regards

Tracey Heers
Marketing Manager
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PO Box 1027, Maleny QLD 4552, Australia
TEL: +61 (0)7 5435 2900 | FAX: +61 (0)7 5435 2911 | www.e-contentmanagement.com

From: eContent Info [mailto:info@e-contentmanagement.com]
Sent: Thursday, 29 September 2011 11:26 AM
To: admin@e-contentmanagement.com
Subject: FW: Permission to use article for thesis

Penny Henderson
Operations Manager
eContent Management Pty Ltd
Scholarly Research for the Professions

From: Kim Soh [mailto:K.Soh@curtin.edu.au]
Sent: Saturday, 24 September 2011 1:33 PM
To: info@e-contentmanagement.com
Subject: Permission to use article for thesis

Dear Sir/Madam

Appendix Seven

Permission to Reproduced Figure In This Thesis

Appendix 7.1 Permission to reproduced staging of pressure ulcer

National Pressure Ulcer Advisory Panel (NPUAP)
Request for Permission to Use NPUAP Product

Name & Title Kim Lam Soh

Company Curtin University

Address School of Nursing and Midwifery, Australia

City, State, Zip Sydney, NSW, 2138

Email: K.Soh@curtin.edu.au **Phone:** 61404216831

I hereby request permission for use of NPUAP (2007) Staging of Pressure Ulcers in PhD Thesis

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Return to: David Saunders, Executive Director NPUAP
1025 Thomas Jefferson St, NW
Suite 500 EAST
Washington, DC 20007
E-mail: npuap@npuap.org

Permission approved: Jennifer Barr **Date** 10/3/2011

Approved by BOD, 6/17/10

Appendix 7.2 Permission to reproduced action research cycle

RE: Permission to reproduction of action research cycle
Rachel Thomas [Rachel.Thomas@heacademy.ac.uk]
You replied on 30/09/2011 4:59 AM.
To: Kim Soh
Cc:

Dear Kim,

I have spoken with Helena Lim who says you are more than welcome to use the document, providing it is referenced appropriately.

If there's anything else we can help with, do please let me know,

Best wishes,

Rachel

Rachel Thomas
Academic Development Officer (Wales and Northern Ireland)

Higher Education Academy
Tel: +44(0)2920471520
Mob: +44(0)7720968829 (*please note new mobile number*)
Skype: rachelthomas753
Email: rachel.thomas@heacademy.ac.uk

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Inaugural Future Directions conference - Graduates For Our Future, 26 April 2012, Glyndwr University

From: Kim Soh [mailto:K.Soh@curtin.edu.au]
Sent: 28 September 2011 22:28
To: Rachel Thomas
Subject: RE: Permission to reproduction of action research cycle

Dear Rachel
Thank you. I will wait for the confirmation.
Regards
kim

Soh Kim Lam
PhD Candidate| Centre for Cardiovascular and Chronic Care| School of Nursing and Midwifery| Faculty of Health Sciences | Curtin University of Technology| Curtin House| 39 Regent Street| Chippendale| New South Wales | Telephone +61 2 83997837| Facsimile +612 83997834 K.Soh@curtin.edu.au

From: Rachel Thomas [mailto:Rachel.Thomas@heacademy.ac.uk]

Permission to use resources
Karen O'Rourke [Karen.O'Rourke@heacademy.ac.uk]
You replied on 8/10/2011 7:30 AM.
To: Kim Soh
Cc: Sandra Coe

Dear Kim

I apologise for the delay in getting back to you. I can confirm that we are happy for you to use the resources you mention in your email as long as you reference both the Higher Education Academy and the Hospitality, Leisure, sport and Tourism Network.

Please do contact me if you have any questions.

Kind regards
Karen

Karen O'Rourke
Communications Manager
Direct line +44 (0)1904 717543

Higher Education Academy
Innovation Way, York Science Park
Heslington, York YO10 5BR

www.heacademy.ac.uk

Appendix Eight

Permission to Reproduced Instrument In This Thesis

Appendix 8.1 Permission to reproduced Revised Professional Practice Environment Scale (RPPE)

RE: RPPE Scale

Duffy, Mary E. [MDUFFY1@PARTNERS.ORG]

You replied on 29/07/2009 9:03 AM.

This message was sent with high importance.

Attachments can contain viruses that may harm your computer. Attachments may not display correctly.

The sender of this message has requested a read receipt. Click here to send a receipt.

To: Kim Soh
Cc: Duffy, Mary E.
Attachments: RPPE Scale 39 items corresponds to JONA 2009 article 7-21-09.doc(124KB)

Dear Kim:

Thank you for your clarification. Now I know exactly what it is you want to do with the RPPE should you decide to use it. Please consider this email evidence of your permission to use the RPPE in your dissertation research project. Please be advised that the instrument was developed for use at Massachusetts General Hospital and what it purports to measure may not be content or construct valid for use in your institution in Australia.

I have attached a copy of the 39-item RPPE in Word format. Since we have not completed revision of the materials to accompany the RPPE and its use, you will have to look at the instrument using the JONA article definitions of the 8 subscales and the tables to see which items make up the specific subscales and their associated Cronbach's alpha internal consistency reliabilities. The subscales are named: Leadership & Autonomy in Clinical Practice (5 items), Staff Relationships with Physicians (2 items), Control over Practice (5 items), Communication about Patients (3 items), Teamwork (4 items), Handling Disagreement & Conflict (9 items), Internal Work Motivation (8 items) and Cultural Sensitivity (3 items).

I wish you the best of luck in your future research endeavors. Please let me know if I can be of any further assistance.

Mary E. Duffy, PhD, FAAN
Senior Nurse Scientist
Yvonne L. Munn Center for Nursing Research
Massachusetts General Hospital
275 Cambridge Street, POB 4th Floor
Boston, MA 02114

From: Kim Soh [mailto:K.Soh@curtin.edu.au]
Sent: Mon 7/27/2009 10:55 PM
To: Duffy, Mary E.
Subject: RPPE Scale

Dear Prof Duffy,

Thank you for your response to my email. All apologies for any misunderstanding

Appendix 8.2 Permission to reproduced Sustainability Index

RE: Permission for reproduction of NHS Sustainability Model
Mark Mugglestone [mark.mugglestone@institute.nhs.uk]
To: Kim Soh
Cc:

Hi Kim
I am happy for you to use the sustainability model in your research. If you need anything else please let me know

Best wishes

Mark

Mark Mugglestone
Head of Innovation
NHS Institute for Innovation and Improvement
www.institute.nhs.uk
t: 07771 931528

From: reception **On Behalf Of** Enquiries NHS
Sent: 31 October 2011 09:03
To: Mark Mugglestone
Subject: FW: Permission for reproduction of NHS Sustainability Model

Reception
NHS Institute for Innovation and Improvement
Coventry House
Warwick University Campus
Coventry
CV4 7AL

Tel: 024 7647 5800
Email: reception@institute.nhs.uk
www.institute.nhs.uk

From: Kim Soh [mailto:K.Soh@curtin.edu.au]
Sent: 29 October 2011 03:27
To: Enquiries NHS
Subject: Permission for reproduction of NHS Sustainability Model

Dear Sir/Mdm,

I am writing to request permission for use of the NHS Sustainabilty Model for my Study. I'm conducting a quality improvement project to improve patient clinical outcomes in the ICU. I'm using this scale for

Appendix 8.3 Permission to reproduced diagnostic criteria for ventilator-associated pneumonia and catheter related blood stream infection

RE: Permission for reproduction of the CDC Diagnostics criteria for VAP and CRBSI
MMWR Questions (CDC) [mmwrq@cdc.gov]
To: Kim Soh
Cc:

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From: Kim Soh [mailto:K.Soh@curtin.edu.au]
Sent: Friday, October 28, 2011 10:39 PM
To: MMWR Questions (CDC)
Subject: Permission for reproduction of the CDC Diagnostics criteria for VAP and CRBSI

Dear Sir/Mdm,

I am writing to request permission for reproduction of the CDC Diagnostics criteria for VAP and CRBSI. The reference are:

1. Centers for Disease Control and Prevention. *Ventilator-Associated Pneumonia (VAP) event.* 2009 March 2009 [cited 2009 Aug 29]; Available from: http://www.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf.

2. Centers for Disease Control and Prevention. *Examples of clinical definitions for catheter-related infections.* 2002 [cited 2009 6 Aug]; Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5110a2.htm.

I am a PhD student currently enrolled at Curtin University in Australia. I'm using the diagnostic criteria for assessment of VAP and CRBSI in ICU. I would like to use the diagnostic criteria in the thesis.

I'm writing to ask for permission. If you are not able to give the permission, I would appreciate if you let me know who to contact for the permission.

Your assistance with this request is much appreciated. Thanking you in advance.

kim

Soh Kim Lam